THE ELECTRICAL WORLD

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Telpherage.

The tendency of the conservative inventor is toward preserving old forms with which he was previously familiar, in adapting his invention to the uses of the public. This is very commendable within certain limits. For instance, Mr. Edison, in introducing his system of electric illumination, adhered as far as possible to the forms of lamps and modes of lighting and extinguishing which had become familiar to the people in the use of gas. His electric mains, branches, meters, brackets, electroliers and switches are, in effect, so many main and branch pipes, meters, brackets, chandeliers and gas-cocks of a gas-lighting system. Therefore that portion of his system which is in the hands of the general public can be managed by it with but little or no additional education, leaving only the prime apparatus and its management to skilled labor and attendance, such as had to be taught its intricacies.

But the best results are not always attained by the inventor in this way, especially when his invention is to be handled only by the skilled for the benefit of the many. Where skill is to be employed the best results are often to be attained by a new departure from the practice of the past. This is peculiarly the case in this most recent system of transportation, called TELPHERAGE.

The name Telpherage was coined by Prof. Fleeming Jenkin, who conceived the invention which is being so successfully developed to practical value by the joint labors of Professor Jenkin himself, and Professors Ayrton and Perry. This trio needs no introduction to the readers of THE ELECTRICAL WORLD, for their names and works are known to all interested in electrical matters. Professor Jenkin said, in his inaugural lecture at the University of Edinburgh: "The transmission of vehicles by electricity to a distance, independently of any control exercised from the vehicle, I will call Telpherage. The word should, by the ordinary rules of derivation, be telephorage, but as this word sounds badly to my ear, I ventured to adopt such a modified form as constant usage in England for a few centuries might have produced, and I was the more ready to trust to my ear in the matter, because the word Telpher relieves us from the confusion which might arise between Telephore and Telephone when written." From roads to tracks, from cart to car, and from horses to locomotives were but changes in the direct line of betterment. From road, cart and horse to track, car and endless cable was a departure from the beaten track which marked originality of a high order, familar as we may be with the cable road to-day. In all these cases there is a stationary road or track upon which the cart or car is hauled; and they are firmly placed on *terra firma* to bear the great loads which they intermittently sustain. He, then, who invented the true cable-road, which is movable as a whole in the direction of its length with the load upon it, was an innovator of no mean ability.

Electric railways have thus far been patterned after the steam locomotive railway, Its roadway has been their roadway; its locomotive their locomotive—in outward appearance; as it goes they go, and so on to the end of the chapter. As it was urged against the first steam locomotive that it would scare the cows of the country through which it traveled so that they would go dry, Mr. Edison may have made his electric locomotive so that it would not scare the cows by change of appearance in that with which they may now think themselves familiar. In telpherage we have another innovation which seems to have within it the elements of success, and it comes to fill a place in the great arteries of communication which seems eminently appropriate for it.

The most sanguine stage-driver or teamster does not expect to compete with the railway; neither do they who know most about electric railways expect to drive the steam locomotive from the trunk-lines. So the advocates of Telpher roads, or rather, lines, modestly expect to take a place subordinate to that of steam and electric railways; to act as collectors and distributors for the trunk and main branches of the systems of inter-communication and transportation. But this place is of vast extent and immense importance in the aggregate, as the minute veins and arteries of the human system, far outnumbering the main ones, are equally important as a whole. There are so many localities where short, inexpensive, and easily operated lines of transport are desirable, it now appears that sooner or later Telpher lines as at present constituted, or as they will be improved, must come into extensive use.

Generically considered, a telpher line system consists of a single-rail or rod track of considerable length connected with a source of electricity placed at some conveniently-suitable place at or near the course of the track, and an electro-locomotive running thereon, deriving its motive power electrically from its track and drawing after it on the track a number of small holders of freight or passengers, the locomotive being controlled as to its motion from a place or places other than on itself. Specifically, the line is elevated above lines of ordinary travel on standards which insulate the line from earth.

Professors Jenkin, Ayrton and Perry have placed their telpher interests in England in the hands of the Telpherage Company (Limited), which has had some experimental lines erected at Weston, near Hitchen, in Hertfordshire, England. The Electrical Supply Co., of New York City, the agent in this country of the Telpherage Company, has handed to us a photograph of a section of one of these lines. The photograph we have copied and present it on our first page (Fig. 1). We also reproduce from a recent issue of *The Telegraphic Journal and Electrical Review*, of England, an engraving representing a section of another line at the Weston Works (Fig. 2). These two cuts represent two distinct telpher systems, one being the "Series" and the other the "Cross-Over-Parallel." The significance of these designating terms will be understood from the descriptions we here present.

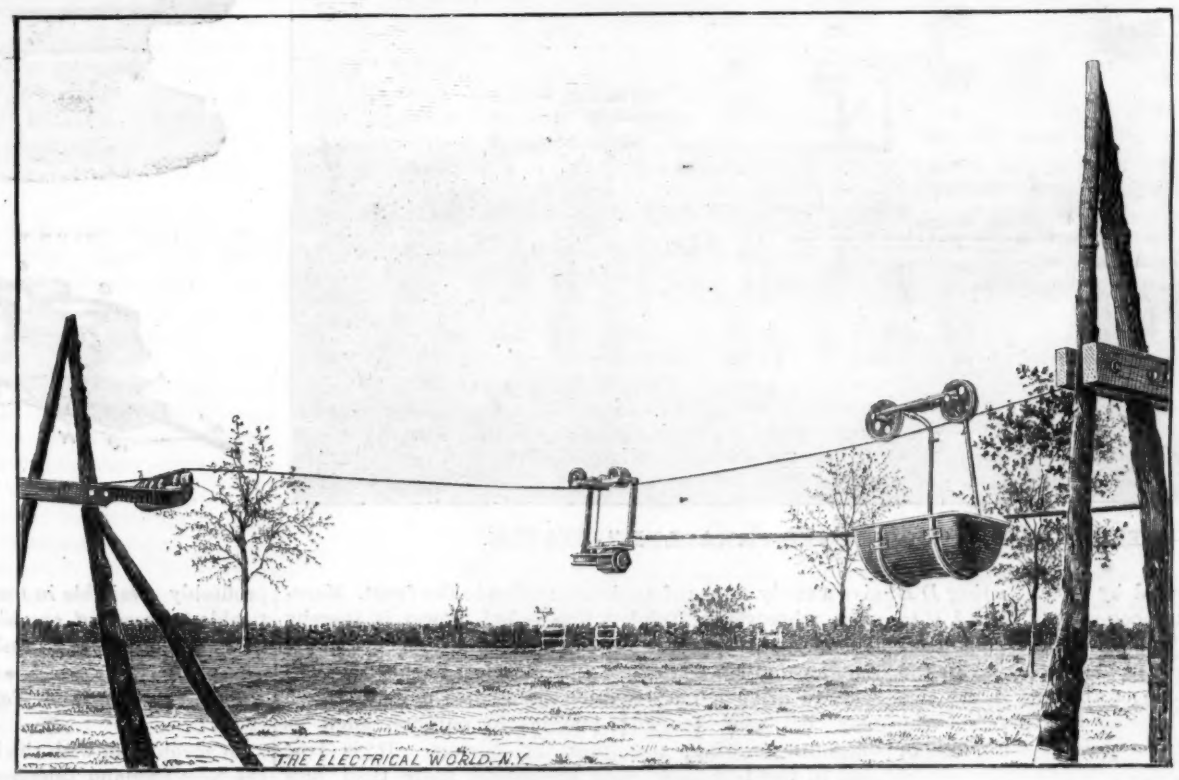


FIG. 1.—TELPHERAGE: THE "SERIES" SYSTEM.

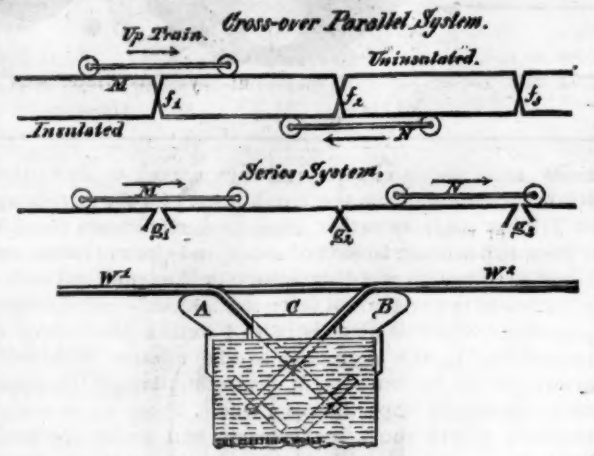
Fig. 3 is a diagram which we will use to explain the principle of the "cross-over-parallel" system, and Fig. 4 is diagram for use in explaining the "series" system. Let *M* and *N*, in Fig 4, represent two trains of cars running on the line upon which the wheels bear. The line has make-and-break mechanism at g^1 g^2 g^3, points say 120 feet apart. These make-and-breaks are normally closed, so that a current of electricity may flow from end to end. But as an electric train is started over the line, say from left to right, when the forward wheel (the motor) strikes the make-and-break g^1 it opens the circuit by moving the latter, and then the current takes the course through to the rear wheel of the train, the electric motor receiving the electric current from which it derives its power of movement. The train is made a little longer than the 120 feet between breaks, so that when the forward wheel strikes break g^2, though it opens the circuit there, the current still flows through the train, spanning the section of the line from g^1 to g^2. But when the rear wheel of the train strikes the break g^1 it closes it, so that current may still flow through the line and train. As the train progresses it successively opens the line circuit by the "break" under its foremost wheel, and closes the line circuit by the "make" under its rearmost wheel, so that the current for the electro-locomotive is derived from the sections of track under the forward and rear wheels of the train, while the track under the train itself receives no current. It is plain that any desired number of trains may be run upon the line at once, it being only necessary, as far as power is concerned, to have the electromotive force of the source of electricity adapted to the number of trains operated.

Fig. 1 shows this series system as it is erected in Hertfordshire. The rough posts carry cross-arms securely bolted to them. On the overhanging ends of these arms are the junction blocks for the ends of the sections. These junction blocks are placed only on alternate posts, because the posts are 60 feet apart, and the sections of the line are 120 feet. The intermediate posts carry only suitable supports for the line. Fig. 5 represents one of the junction blocks. *A* and *B* are cast steel supports bolted down on a wooden block, which latter is itself bolted to the end of the cross-arms, or this block may be the end of the cross-arm itself. The upper surfaces of *A* and *B* are channeled to receive the conductors W_1 and W_2. These conductors pass one on each side of the cast steel piece *C*, and go through holes in the wooden block, being secured in the latter by nuts, as shown. The piece *C* is bolted on the wooden block in a position intermediate between *A* and *B*, but is insulated from them. This piece serves as a continuation between the rods W_1 and W_2, so that the wheels of the locomotive and skips can ride from W_1 to W_2 with regularity and smoothness. The current is returned either by earth, a return conductor or, preferably, by a return line over which the locomotive may run. There is but one wire rope which carries *both* the load and the current. The rope is $\frac{5}{8}$ of an inch in diameter. The load carried is in seven skips, one of which is seen in Fig. 1. About half a ton is put in each skip and the speed is six miles per hour.

For a description of the principle of the "cross-over-parallel" system let us consider fig. 3. Let the dark line proceed from the positive, and the light line from the negative binding post of the stationary dynamo. At f_1 f_2 f_3, the lines are electrically crossed, so that adjacent sections on the two lines are oppositely positive and negative. Therefore, it is plain that current must flow through the trains and locomotives. The trains are in this case made as nearly as possible the length of one of the sections of the lines. If this were not the case the train might stop on the line by having two contacts of like polarity. It would not be safe to depend upon the momentum of the train to carry it over the neutral points, as that might fail to be active at a critical point. The inventors announce that they have an electrical device called a "step" to overcome that objection, but are not yet ready to describe it to the public. This is called the "cross-over-parallel" system, because the current crosses over from the up-line to the down-line and *vice versa*, and the current is divided "in parallel" between the two trains, instead of passing through them "in series." The cross of the current is effected by cross connections between the ends of the sections at the junction-blocks in obvious manner. In this case the cross-arms on the posts or standards carry each two supports or junction-blocks, as the case may be.

It will be observed that in these illustrated cases the electro-locomotives are supported below the line from trucks which run on the line, and that the same is the case with the skips. The power of the motor is communicated to the driving wheels on the line by shaft or belt. The wheels which support the motor and skips have V-shaped circumferential grooves which fit over the line, and which serve to keep the wheel in track. The hauling grip is obtained by wheels which are driven by the connection from the motor and are pressed by springs equally to grip between them two sides of the line. Various devices have been used by the inventors for gripping the line. One of these, patented in the United States, we herein illustrate. The motor used is that so well-known as the Ayrton & Perry motor, fully described by those gentlemen in their pamphlet entitled "Electro-Motors and Their Government." One weighing 96 pounds gives 1½ horse-power. It is illustrated in Fig. 6.

The principle utilized for gripping the cable, rod or rail is well illustrated in Figs. 7 and 8, which show a motor which is mounted, with the gripping attachments on a rail instead of hanging below, as shown in Figs. 1 and 2. Fig. 7 is a perspective view, and Fig. 8 is a plan view of the working parts. The electrical connections to the traction-motor is from the main rail *A* through one of a pair of wheels *R R*, which support the weight of the motor-carriage, said wheel forming a rolling contact, and thence through an insulated wire *a'*, to the rotary electrical motor *C*, and the return from the motor through a wire a^2, and the hauling-rope *N'*, as aforesaid, are clearly shown in the perspective view, Fig. 7. The rotation of the



FIGS. 3, 4, 5.

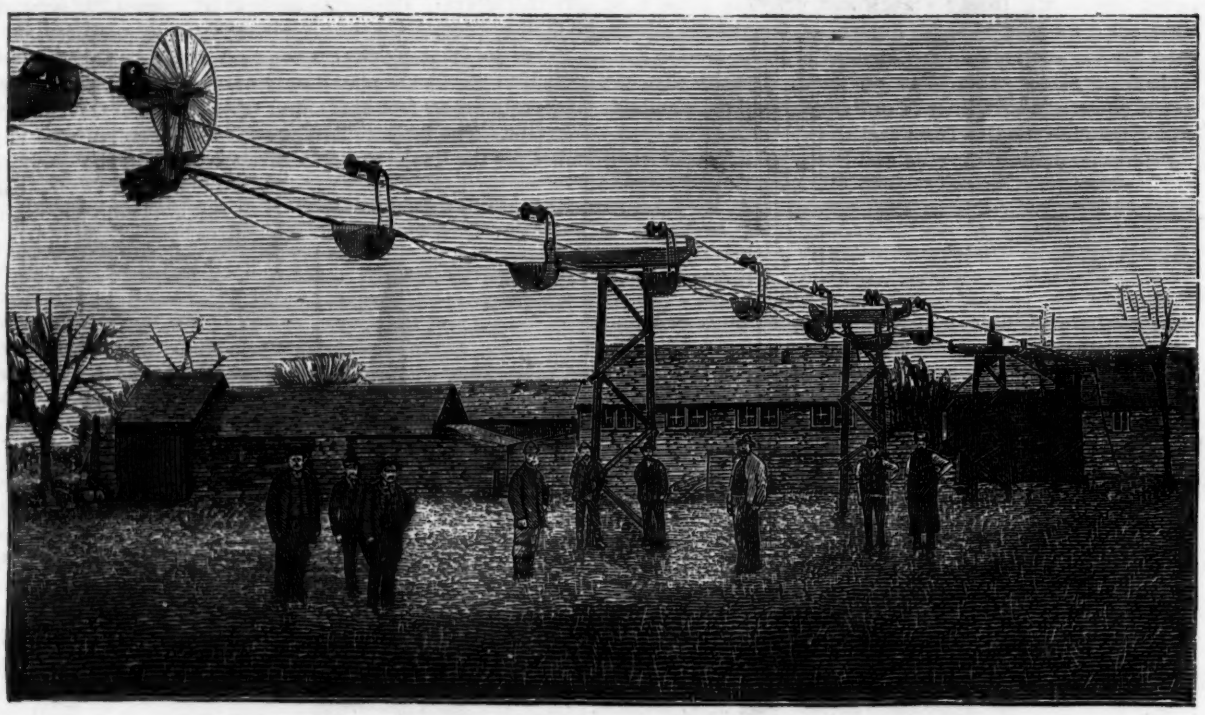


FIG. 2.—TELPHERAGE: "CROSS-OVER-PARALLEL" SYSTEM.

electrical motor *C* is communicated by bevel-gearing *D E* to a pinion *F*, and thence through cog-wheels *G* and *H* to the driving-axles *g* and *h*, on which are the driving-wheels *I* and *J*, which bear upon the rail *A*. Opposite to the driving-wheels, on the other side of the rail *A*, are two pressing wheels *L* and *K*, which, being capable of moving in slotted frame-bearings, can be pressed with less or greater force against the rail.

For haulage there is used a metallic bar, *N*, Figs. 7 and 8, provided with insulated draw hooks *h'*. The hauling line *N'* may be attached to either end of the bar *N*. This bar carries a pivot or stud passing through the joints of the links *O P O P'* at *O*. The haulage-pull received on the said stud or pivot at *O* draws the ends *P* and *P'* of the links *O P O P'* closer together, thus compressing the spring *Q*, and forcing the pressing-wheels *K* and *L*, and consequently also the driving-wheels *I* and *J*, more forcibly against the rail *A*, in proportion to the increase of haulage-strain. The gripping-wheels *I J K L* are preferably arranged in two pairs, one on either side of the rail, as shown in Figs. 7 and 8.

This last motor and telpher line is for the purpose of hauling cars along a track laid on the ground by means of the motor, which runs along a cable elevated above the road. This may also be made useful for hauling canal-boats.

Prof. Jenkin, in his lecture before referred to, said: "I am almost afraid to speak of the probable uses to which Telpherage may be put. If I said all I thought, I should be told I was describing an electrical Utopia. The first and most obvious use of a Telpher line is that to which existing wire tramways are already put, namely, the conveyance of minerals or ore from mines to canals, railways or the sea. The suspended wire rope is specially suited for rocky, uneven ground, and very heavy gradients could be worked. The Telpher line has the following advantage over the present system: It can go round sharp curves, change the gradient as often as is desired, and be made of any length; any train can be stopped and shunted without stopping the others. If made with no working parts, as in the present example, the permanent way may be left idle for part of the year with no sensible deterioration.

"Mineral traffic of this kind is, however, in my opinion, only one small part of the work which these lines can do. Where railways and canals do not exist, Telpher lines will provide the cheapest mode of inland conveyance for all goods—such as corn, coal, root crops, herrings, salt, bricks, hides, and so forth—which can be conveniently subdivided into parcels of one, two, or three hundredweight. In new colonies the lines will often be cheaper to make than roads, and will convey goods far more cheaply. In war they will give a ready means of sending supplies to the front. Moreover, wherever a Telpher line exists, power is thereby laid on, and this power may be used for other purposes than locomotion—a flexible wire attached to the line will serve to drive a one, two, or three-horse engine, which may be used for any imaginable purpose, such as digging, mowing, threshing, or sawing. It is true that in the transmission of the power more than half

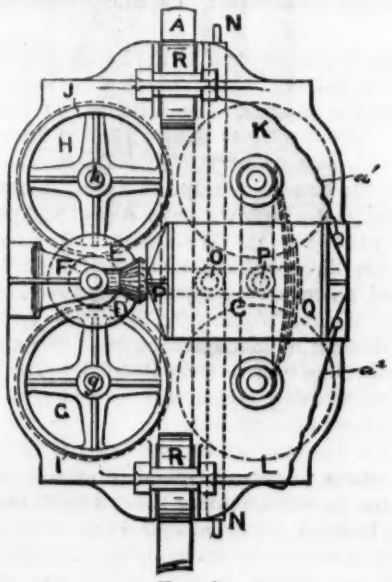


FIG. 8.

may be wasted, but the proportion is diminishing yearly, monthly, almost daily, with the growth of our electrical knowledge; and when we remember that by stationary engines in London power can be produced at the rate of about one halfpenny per hour for each effective horse, we shall not be alarmed at the prospect of doubling this cost when the power is delivered on a rough hillside—especially when we remember that the engine receiving that horse-power need weigh no more than 100 lbs. Surely I am not too sanguine in expecting that great changes will be produced in agriculture by these new facilities for transport, coupled with the delivery of power at will from any point of the Telpher road. It must not be supposed that I look on the new Telpher lines as likely to compete with railways or injure their traffic. On the contrary, my feeling is that they will act as feeders of great value to the railways, extending into the districts which could not support the cost even of the lightest railway. It is idle to endeavor to foretell the future of any new idea; but this much is certain—a novel mode of transport, offering some exceptional advantages, will be publicly shown on a practical scale to-day."

It would seem, at the first glance, that the capacity of a telpher line for carrying freight must be small. But it is perfectly practicable to run a procession of trains over a line with proper terminal facilities at the rate of six miles per hour. Let the distance between two trains be 120 feet, or their locomotives 240 feet apart, and the skips carrying 15 cwt.; at that speed 99 tons of freight will pass a given point per hour. This aggregates 1,920 tons of freight for twenty hours, one way. As the line is double "up" and "down" trains can be run, so that nearly 4,000 tons of traffic can be transacted over the line per day. The inventors claim that they have, by their devices, secured absolute control from the dynamo station of the trains on the line, without possibility of collision or stoppage on the track. These devices have not yet been described for public use. Nothing seems to stand in the way of practically perfecting a system of electric transportation that will be profitably available in many places, such as those impracticable for roads of any kind, and those where better facilities are required at a minimum cost. □.

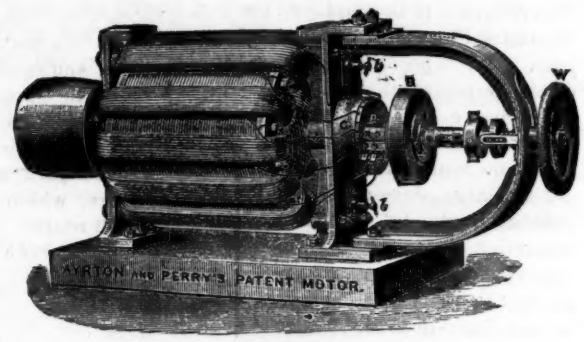


FIG. 6.

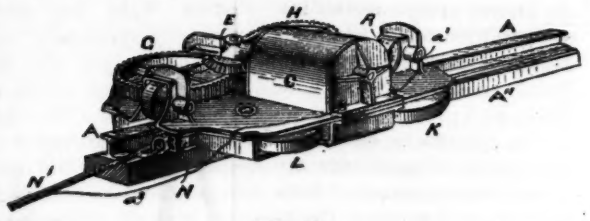


FIG. 7.

The New England Telephone and Telegraph Co.

In accordance with the by-laws, the annual meeting of the New England Telephone and Telegraph Company was held at 144 Greenwich street at 11 A. M., May 5, President Vail in the chair. There was a large representation of stock in person and proxy. The treasurer's six months report was read, showing earnings $412,463.24 and expenses $275,587,91, or net earnings $136,875.33. The dividend paid January 25, 1884, amounted to $73,395.

Statement of Assets and Liabilities, March 31, 1884.

ASSETS.

Licenses	$4,268,000.00	
Plant	5,871,063.41	
Unissued and treasury stock	1,836,400.00	
New construction	66,393.98	
Bells, material and supplies	61,699.56	
Accounts receivable	77,699.17	
Cash	16,818.55	
		$12,198,075.67

LIABILITIES.

Capital stock	$12,000,000.00	
Bills and accounts payable	100,922.71	
Advance rental account	33,487.63	
Unpaid dividends	185.00	
Income account	63,480.33	
		$12,198,075.67

Net gain of the subscribers for the six months	1293

A ballot for directors resulted in the election of the following: Theo. N. Vail, Wm A. Ingham, Wm. H. Forbes, Chas. P. Bowditch, Chas. J. Glidden, Alexander Cochrane, John E. Hudson, S. Salesbury, jr., and Fred'k Ayer. At a subsequent meeting of the directors Theo. N. Vail was elected president; Wm. A. Ingham, vice president; Wm, R. Driver, treasurer; Chas. J. Glidden, secretary and auditor; Loren N. Downs, general manager; Wm. H. Bent, attorney.

Electricity in the Last Century.

Leading scientific men have bestowed some little attention lately on bygone electrical experiments and studies. One of our readers, who has been turning over some old papers, enables us to supplement recent investigations into the forgotten lore of electricity with the subjoined article from *The Gentleman's Magazine*, 1758, entitled "A new way of procuring the electric shock with a substance very different from glass." It is apparently one of the earliest of the efforts to produce frictional electricity from non-vitreous materials. It runs thus:

"Several persons concerned in electrical experiments having supposed that glass, or at least some material nearly approaching to a state of vitrification, was absolutely necessary to make what they call the Leyden experiment with success, the following experiments were tried: A friend of M. de Tour, of the Royal Academy at Paris, having brought him a leaf of that sort of talk commonly called moscovy-glass (and sometimes, improperly, isin-glass), a substance, as is well known, that has nothing in common with glass but transparency, and is not even susceptible of vitrification, he had a fancy to try if it might not be substituted instead of the glass square in Mr. Franklin's experiment, in order to do which he placed the leaf of the talk on the end of the electrical bar, and pressed the fingers of one of his hands upon it so that the leaf was between his fingers and the bar; then with the other hand he drew a spark from the bar. On the upper plate M. de Tour layed a playing card, and placing one end of a blunt iron pin thereon, and touching the bar with the other end, a strong spark like lightning pierced the cards. This was seven or eight times repeated, and then it would succeed no longer, though the bar continued electrified. The next day, upon examining the leaf of talk, he perceived there were some cracks and two small round holes in it; then he placed it on the bar, and pressing his finger on a part of it, which was a good distance from the holes and cracks, he drew a spark with the other hand and felt the commotion; yet, though he placed it between the plates with all possible attention and care, he could not succeed in piercing the card. He then cut off the cracked part, and thereby reduced the leaf to three inches square, which he gilt on both sides, leaving a bare border all round. In this condition he employed it again with success, both in the Leyden experiment and in piercing the card."

The Use of Illuminated Girls.

Both in this country and in Europe, the adornment of ballet girls with the electric light has added remarkably to the brilliance and attractiveness of their performances. According to Mr. Alden, of the New York *Times*, the idea has been carried out to an extent hardly expected even by Mr. Edison. He says: "The formation of the Electric Girl Lighting Company is an event second in importance only to the invention of electric lights. This company proposes to supply girls of fifty-candle power each in quantities to suit householders. The girls are to be fed and clothed by the company, and customers will, of course, be permitted to select at the company's warehouse whatever style of girl may please their fancy. A very beautiful design for a front-hall girl is now on exhibition at the company's office, No. 409 Gold street. The present system of lighting the front hall of a dwelling-house has the disadvantage that the light—whether it be a gas light or an electric light—must be kept burning all the evening, and that a servant must be employed to answer the bell. Thus there is a double expense—the cost of the light and the cost of the servant. The Electric Girl Lighting Company will furnish a beautiful girl of fifty or a hundred-candle power, who will be on duty from dusk till midnight—or as much later as may be desired." The electric lighting girl is also recommended as being far superior in beauty and convenience to massive chandeliers and students' lamps.

Static Electricity.

BY JOHN C. SPIELMAN, IOWA CITY.

I send this item, thinking it may be new and of interest if not of practical value.

In one of the recitation rooms of the University here, they use a patent paper black board consisting of strong manilla paper painted with a prepared slating and pasted to the wall.

Talc crayons are used, and the professor erases the work of the previous exercise before the next class arrives. The friction between the felt eraser, covered with talc dust, and the blackboard, charges the latter with electricity, so that by applying a finger, one gets quite a spark.

The class have had more than one laugh at the unwary student who used his finger to point out some part of a problem. One received a spark from the oil-cloth top of the Professor's table. It probably had been charged from the board through the Professor.

Recently chalk has been substituted for the talc crayons, and the trouble has ceased.

Will some of our readers tell why the substitution of chalk crayons for talc ones made the change in electrical condition?—ED. THE ELECTRICAL WORLD.

The Moscrop Continuous Recorder.

It is generally conceded that the introduction of the electric light into common and extensive use has had a marked effect on high-speed engines, leading to many improvements in them. At an early day the discovery was made that it was not enough to have good apparatus, in the shape of efficient lamps and dynamos that would give a high percentage of available electrical energy after the process of conversion had taken place. What was wanted for arc and incandescent systems alike, was a

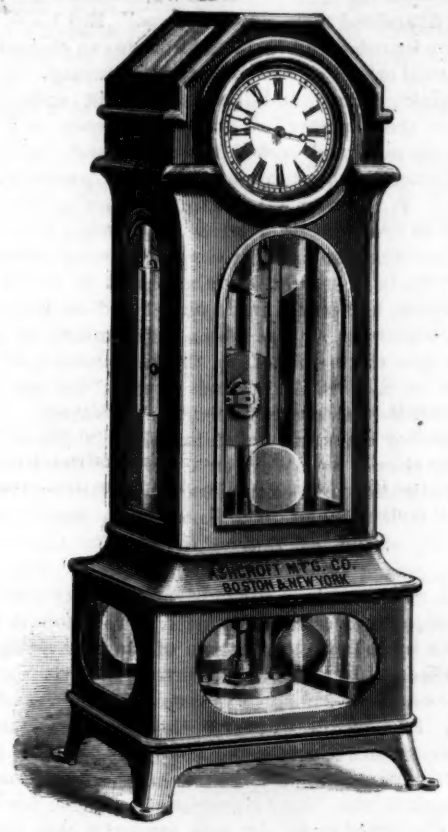


FIG. 1.

steam engine of high speed capable of running with the greatest steadiness. The demand arose thus for engines of high and regular speed, to meet requirements far more exacting than those to which, as a rule, engines have to answer in running machinery in mills and factories; and the readers who have followed our descriptions of steam engines for driving dynamo-electric machines know that the demand has been met, with much credit to American engineering and mechanical skill.

Provided with lamps, dynamos and the best engines ob-

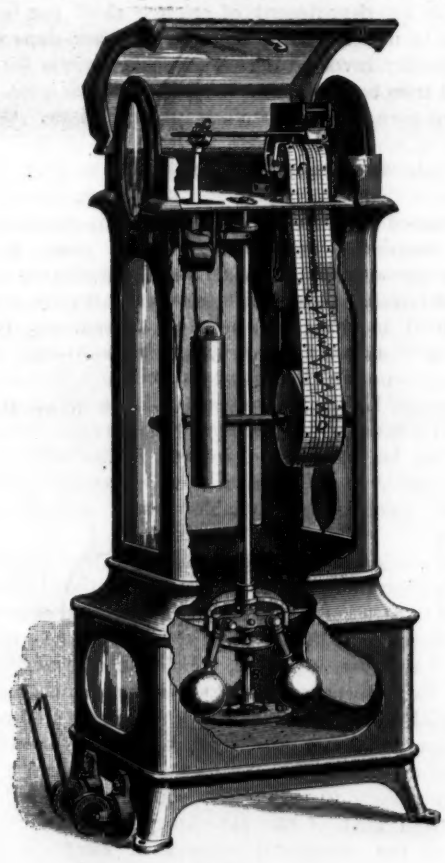


FIG. 2.

tainable, the electric-light engineer knows that his main desideratum now is a continuous and uniform steam pressure, and he needs to be assured that he is getting this. In other words, he requires to be informed of any fluctuations in speed of engine and shafting. We have already devoted considerable attention and space to this point, and now take pleasure in presenting a few notes, with illustrations, of the Moscrop Continuous Recorder, which has already been applied with great success to engines driving dynamos. This device was invented and patented by Mr. J. B. Moscrop, of Manchester, England, and the exclusive control of it in this country vests in the well-known Ashcroft Manufacturing Company, whose New York headquarters are at 111 Liberty street. It is designed to furnish an accurate reading, comprehensible at a glance, of the time of starting, of all and any variations from the requisite normal speed and of the precise time at which the irregularity occurred and of the time of stopping. Thus the electrician is assisted in maintaining the efficiency of the department from which he derives the initial motive power, and is free to devote his cares to the other and public parts of the installation that is under his supervision.

The two illustrations convey a good idea of the exterior appearance and internal mechanism of the Recorder, which occupies twenty-one inches square of floor space and stands four feet six inches in height. It consists of a strong and by no means inelegant iron case, with glass sides, containing an eight-day pendulum clock, as shown in Fig. 1. This clock is connected with and moves a roll or continuous band of paper. On this band, which will last three months, the autographic record is made by an inked marker. The relation or adjustment of the various parts is seen in the sectional view, Fig. 2. The inked marker responds to the motion of the governor balls seen in the base of the instrument, the balls rising and falling as the speed of the engine changes. The belt *A* is brought in from the shaft whose revolutions are being noted, under the idler pulleys in the rear of the base of the recorder to a horizontal pulley that should be speeded at from 84 to 96 revolutions per minute, if possible at 90. This pulley is secured to the upright shaft *B* that rises through the centre and extends upward to the clockwork and marking mechanism. To the shaft *B* are attached the governor balls, which rise by centrifugal force when the central shaft is revolved. Their upward motion is transmitted by means of a sleeve covering the shaft to the bell crank *C* at the back of the clock movement. The crank is attached to an arm carrying the marker. When the engine has attained its normal speed the marker comes up to the longitudinal line *D* on the paper, and so long as speed is uniform a straight record will be made such as is seen on the upper part of the paper, from *E* to *F*. In the event of unevenness, the engine will write itself down as needing attention, with a record like that shown from *D* to *E*. Each of the parallel divisions denotes an increase or decrease of speed, the lines to the left showing increase, and those to the right a decrease. Thus, should the speed of the engine be increased 5 per cent., the ink-marker would pass over the paper to the next parallel line to the left. The marker is pushed entirely off the paper when the engine stops, and it is unable to make any record until the engine is started up again. At equal distances along the band in Fig. 2, black dots will be seen. They indicate perforations, and the space between them represents one hour with its subdivisions. The length of interval between the starting and stopping of the engine is obtained in this way, as well as the exact moment when any variation of speed has happened. The unsteadiness caused by the intermittent impetus given to the piston by the steam is detected by the degree of width in the line made on the record; and the unsteadiness due to the variation of load is revealed by the comparative crookedness of the line.

A special book is provided if desired, in which the records can be kept for reference. It is so arranged that each line represents a day, and each page a week, to which the date is put when the record strips are pasted in. In this manner an engine may be made to write its own life-history, and from a volume of this kind valuable data can be drawn whenever wanted.

Testimonials have been given by those who have used it, speaking of the Moscrop Recorder in the highest terms.

The Aid of Electricity in Viticulture.

It would appear from a recent article in the *Progres Agricole*, of France, that an important use may be found for electricity in vineyards. One of the dangers to which vines are exposed, in the Spring especially, is a sudden fall in temparature, and it seems, that by the aid of electricity, this danger can be averted. That is to say, it may be used indirectly in simultaneously setting aglow all over the vineyard a series of little hillocks of damp brushwood smeared with tar. The invention of the process is due to M. Lestelle, an inspector of telegraphs living at Mont de Marson. Quite recently this electrician experimented in a park at Bordeaux which the municipal authorities placed at his disposition. The experiments that were there made at intervals of two days were for the purpose of demonstrating to the viticulturist the practicability of the process. It cannot be said that the experiments were altogether successful, but enough was seen to induce the belief that the process has much to commend it. The process consists in connecting the various sections of a vineyard with electric wires in such a manner that when the sudden lowering of the temperature threatens the vigor of the vines a dense smoke may be made to rise all over the fields by the electrical ignition of damp underbrush and tar. The viticulturists say that if the process is practicable no vineyard could afford to be without it.

TO PRODUCE DEAD GILDING.—In an article on color in electro-gilding, a watchmakers' journal says that a dead gilding will be produced by the addition of a little of the fulminate of gold in solution to the bath immediately before gilding, or by dipping the article (brass or copper) before gilding in a mixture of sulphuric and nitric acids.

THE

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Mr. Mailloux's articles are marked thus: *.*. Mr. Keith's thus: □.

The Department of Inquiries and Our Illustrated Record of Electrical Patents are edited by Mr. Keith.

Correspondence on all electrical subjects is solicited. Readers are cordially invited to communicate their views and opinions on all topics within the province of this journal. Items of information relating to any application of electrical science will be thankfully received. Our friends will render us a valuable service by forwarding news *promptly* as it occurs, and by mailing us marked copies of their local papers containing anything likely to interest our readers. Anonymous communications not noticed. Rejected manuscript cannot be returned unless accompanied by the necessary postage when received.

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THE PHILOSOPHY OF SCIENTIFIC STYLE.

Mr. Herbert Spencer in his weighty little essay on the philosophy of style remarks that the more time and attention it takes to receive and understand each sentence, on the part of a reader or listener, the less time and attention can be given by that recipient to the contained idea, and the less vividly will that idea be conceived, the less easily grasped. In other words, the aim of the instructor should be "so to present ideas that they may be apprehended with the least possible mental effort." Our esteemed contemporary, *Science*, takes this latter expression of Mr. Spencer's views as a text for a little discussion on style in scientific writing, a subject of great interest to the scientific press.

The general principles laid down by *Science* are these: "One of the results of scientific study is to make men accurate, to encourage exactness in thought and expression. The first quality, therefore, to be desired in scientific writing is trustworthiness; and, without it, all other merits are of no account. * * * But, in addition to accuracy, scientific writing should be in good form. Indeed, proper attention to literary requirements will promote rather than embarrass the desired precision." It does not follow, however, that because accuracy and exactness are thus encouraged, the faculty of expression is developed; the very reverse may be the case. Concentration of mental energy in one realm of thought or experimentation, will often leave a man deficient in other departmments, and even hinder him from giving to the outer world, in an acceptable manner, the results, established beyond a peradventure, at which he has arrived by long and painstaking effort. His work will remain "caviare to the general" until some one else, perhaps without originality, but having a gift of tongues and interpretation, presents it in a more taking and piquant manner. We have all enjoyed the acquaintance of men, either personally or through their writings, whose big thoughts were hidden by a heavy and confused rhetoric, as the sun may be concealed behind cloud and mist. Their accuracy, their exactitude, or their marvelous rapidity in seeing through things, was of no help to them when they were called upon to express themselves orally or by the pen.

In fact, accuracy to the highest degree may be obtained in scientific research, accompanied by great looseness of literary expression; and we are sorry to add that many graceful literary productions on scientific subjects have been widely erroneous in statement. It would be very easy to find inaccuracies in writings of high merit and repute. Taking up Pynchon's "Chemical Physics," almost the first sentence that chances to meet our eye is this: "By this expression it is not meant that either force or matter *are* incapable of destruction, but simply that, in fact, as the material world is at present constituted, neither of them *is* destroyed in the various transmutations they undergo, but *are* merely changed from one form to another." The book is a very good one in spite of this and other slips. Mr. Hallam writes: "No one as yet had exhibited the structure of the *human kidneys*, Vesalius having examined *them only in dogs*." But his survey of European learning and literature remains an elegant model of impartial criticism and historical accuracy. A writer may think clearly and be precise, in spite of evidence to the contrary in such a sentence as: "Our climate is mild and somewhat moist, and, except when covered once in a year by snow, always presents a green surface." We get at his meaning rather indirectly. A sentence at the close of a series of articles, in a contemporary, on steam engines for electric lighting plants, reads thus: "We have entered upon an *epoch* in steam engine construction, as marked in its *period* and as well-defined as to its *beginning*, as that which at the middle of the last century was distinguished by the introduction of the inventions of Sickles, Corliss and Greene;" but the articles are remarkably accurate in scientific statement.

We do not expect to find Admirable Crichtons now-a-days, nor should we always expect to find the writings of modern scientific men exemplars of polished precision, in literary style. When Mr. Lowell can write: "John Keats, *the second of four children, like Chaucer and Spenser*, was a Londoner," much may by forgiven to scientific men, to whom the cultivation of style and form in expression is a secondary matter, or to whom it may be forbidden by the exacting nature of their investigations. The celebrated Mrs. Inchbald, in reply to criticism, said once she had been informed that correctness was often inelegant. She meant, of course, that perverse inaccuracy might sometimes be preferable, and so the foibles of fashion have occasionally dictated; but, in another sense than that, the remark is true. The exigencies of scientific description or formulation of principles may prevent a close attention to smoothness and euphony, or will demand repetitions and diffuseness that would be intolerable in a purely literary piece of work. We think it is well to make these reserves, in accepting the reasonable dictum of *Science*, quoted above, and to point out also that Mr. Spencer, whom it quotes, insists that good composition is largely dependent on natural aptitude, as "a clear head, a quick imagination, and a sensitive ear, will go far toward making all rhetorical precepts needless."

Another part of the article touches on a second important consideration, namely, the extent to which the worker in one department of science shall use language that can be understood by workers in other departments. The difficulty involved here is far more serious for a journal that tries to be all-comprehensive, like *Science*, than it is for our own, with its well-defined province. Our contemporary says of itself that it should be so written that "every educated person will be obliged to keep his eye upon all that we print," but the readers are few indeed whose minds can skip agilely from volts, ampères and coulombs on one page, to Jurassic dinosaurs on the next, and Caulinites on a third. The popularizing of scientific studies is hardly to be accomplished in that way, but the advantages, from an academic standpoint, of getting this synthesis of new science, are not small. The educated man will certainly read Darwin, Lewis, Huxley or Tyndall with interest, and will find a fascination in Kingsley, Thoreau or Burroughs, but unless he has special interest in the subject, he is utterly unable to sit down and enjoy pages loaded with symbols, formulæ, six-syllable words and doctrinaire pedantry.

As our contemporary puts it neatly, "That which stimulates further thought and invites to continued reading is the kind of article most to be desired," and success is to be found along that line, rather than with the articles of whose "abstruse, complex, scholastic diction" it complains. Our effort is and always has been to fill these pages with articles easily understood. We have succeeded, to judge from what our subscribers say, far beyond the most sanguine expectations. We have been fortunate in getting electricians to write who could wield another language than that of the laboratory or class-room, but thanks to the wonderful advance of electrical science, we are not afraid that when an article is given in technical phrase it will be wasted on the majority of those who get the paper.

THE EDISON INVENTIONS.

We publish on another page a short account of the exhibition at Worcester, Mass., on May 1, of the various inventions of Mr. Edison. To add to the delight of the Worcester folk, Mr. Edison was present. Among the gentlemen who accompanied him were Major S. B. Eaton, and Mr. E. H. Johnson, the *fidus Achates* of the inventor. The former gave at the exhibition a valuable statement with regard to electric lighting, and the latter, to whom Mr. Edison's inventions have generally been known long before the public learned anything about them, explained their merits in an illustrated lecture that was, according to all accounts, of a most interesting character.

If Major Eaton's remarks be correctly reported, the Edison system is making great progress in public favor. In New York City alone there are now, he says, 509 consumers, using about 11,000 lamps, and the Isolated plants in use throughout the country number 310, running some 60,000 lamps. The report of the Isolated Company, made last November, enumerated 275 installations, with 55,755 lamps, so that the business grows apace in the dullest times. It might be wondered at by some that so large a demand could exist. Major Eaton quoted striking figures as to the amount of capital invested in artificial lighting. He said that in London over $60,000,000 is invested in gas supply; in Paris, over $40,000,000; in New York City, $20,000,000; and in the whole of the United States the enormous sum of $300,000,000. These figures and the others above show that, although electricity entered a field that was already occupied, it has found a good foothold and is steadily gaining.

Mr. Edison is reported to have made a significant remark, in casual conversation at Worcester, about the phonograph: "He felt confident he could make it a commercial success if he could devote two years' study in perfecting it." That being the case, it is a very great pity Mr. Edison cannot find the time. But now that the idea or principle of the phonograph is familiar, and has been known for about five years, why does not some other inventor find a general, practical use for it?

ELECTRIC LIGHTING IN THEATRES.

We published in our issue of April 26th an illustrated article on electric lighting in theatres, with special reference to the installation at the Theatre de la Scala, Milan. The subject is an important and interesting one, and is occupying not less attention in Europe than here. The French journal *La Lumère Electrique*, in a recent number, gives details with respect to the use of incandescent lamps in eleven theatres now lighted by electricity only. At the present time, it appears, there are more than 1,200 Swan lamps illuminating the Savoy Theatre, London. The installation at the Brunn Theatre comprises 1,384 Edison A lamps—sixteen-candle power—and 40 B lamps, but never more than 900 are required at once. Five Gramme lamps illuminate the square before the Theatre. At Havana, the Alliser Theatre has an installation of 182 B lamps and 31 A lamps. The Bijou Theatre, Boston, Mass., has about 650 lamps. The Théatre du Parc in Brussels has 350 Edison A lamps, of which, however, only 128 are used in the theatre proper. The Residenz Theatre at Munich has 766 Edison lamps of 16 and 8 candle power, and the Residenz Theatre at Stuttgart has 1,077, 10, 16 and 32-candle power lamps. The number of Edison lamps in use at the Manchester Theatre is 460. At Buda-Pesth, the theatre has an installation of 1,600 twenty-candle power Swan lamps, of which about 900 are lit every evening. The most extensive of all the installations is that at Milan, where 2,500 Edison lights in the Theatre de la Scala and 400 in the Theatre Manzoni are run by the local company. This list is by no means exhaustive, but it furnishes a fair idea of the progress made in the application of the incandescent light to theatres. The descriptions, given at great length by our contemporary, of the arrangements in each case, show that, though the conditions to be taken into account are of the most varied and complex character, they have all been met triumphantly, with the result of adding vastly to the beauty of scenic effects and to the comfort and safety of the spectators.

"LIFE IN THE OLD DOG YET."

The low price of Western Union stock has been a marked feature of business on the Stock Exchange for some time, and it is accepted by many persons as a sign that the company is giving way before so much competition, and actually lies in a moribund condition. Dr. Norvin Green, however, makes out that the company has an abundance of vitality, and is more than holding its own. According to some figures, credited to him in the *Commercial Advertiser* of May 2, the company is gaining ground. In each of the divisions of the country the "test offices" report their earnings weekly. The new tariff has been in effect since March 1—not May 1, as has been reported. In the first week in March, 1883, its receipts from the test offices of the Southern Division were $20,045. In the same week of March, this year, which was the first week after the reduced tariff, the receipts were $18,455. There was a loss $1,500. The second week's receipts for 1884 were about $1,200 less than in 1883. The third week of March, 1884, had $19,021 against $17,659 of the previous year. The last week of March showed an increase in receipts of $1,400 over last year. The reduced Southern tariff on the entire business of the company, the first week of March, 1884, gave a total for all test offices of $167,507, against $169,689 in 1883, a loss of $2,000. On the last week of March the company did a business $11,000 greater than in the previous year. The moral to be drawn from these figures is that blessings often come disguised, and that the competition to which the company has objected, and still tries to prevent, is a good thing as well for itself as for the public.

TOPICS OF THE HOUR.

Two of the leading electrical topics of the hour are "telpherage" and ocean telegraphy. It will be seen that we have special articles on each in the present issue. The information given is of a very instructive and entertaining nature. The description of telpherage is liberally illustrated, so that our readers will be able to understand this striking novelty in all its details.

Resistance Coils.

Prof. S. P. Thompson has introduced a new method of making resistance coils which is likely to prove useful in saving time lost in adjusting the coil to its correct final value, though it may require more wire. The existing method is to cut off a sufficient length of wire to give, say, 2 per cent more resistance than is required; then double it on itself, cut the wire at the bight, bare it, and solder a piece of copper across the naked ends. By keeping the solder soft while the wire is being tested, this bridge-piece of copper can be shifted until the required resistance is obtained. Professor Thompson's method, says *Engineering*, which is best adapted for coils under 10 ohms, consists in first cutting off a length of wire and calculating the resistance which, as a shunt to its resistance (R), will give the final resistance (r) which is required. Let the resistance of this shunt be s then $S = \frac{Rr}{R-r}$. A second length of wire giving approximately this resistance (S) (say 2 per cent. more) is then cut off, and the ends of it soldered to the ends of the first piece. The joint resistance is equal to the resistance r required. Professor Thompson also employs a new form of "metre bridge" in his measurements. There are two wires, one having several times the resistance of the other; and both are 2 metres long. One or other can be used as desired, and the same sliding contact serves for both. This arrangement makes the bridge far more useful and widens its range. When Foster's method is used to give very accurate tests, the interchangeable coils are transposed by means of a mercury cup switch, which can be attached to the bridge. By simply shifting four copper connecting pieces in the mercury cups the transposition is effected. Mr. Shaw, of Cambridge, has designed a special key, whereby the same transposition can be effected by turning an axle, which, by a series of cams, makes and breaks the contacts necessary for the purpose.

Edison Feted at Worcester, Mass.

An electrical exhibition on a small scale was given at Worcester, Mass., on May 1, by Mr. Edison and his associates, under the auspices of the Natural History Society and the Mechanics' Association. Mr. Edison was the guest of these bodies, which were represented by a Reception Committee. Mr. Edison was accompanied by Major Eaton and Mr. E. H. Johnson, as well as by Messrs. Tomlinson, Sterringer, Upton, Russell, Hodgkinson, Borden and Stickney. On the morning of the 2d, the committee, at the head of which were Dr. W. H. Raymenton, President of the Natural History Society, and Mr. Hildreth, President of the Mechanics' Association, escorted the Edison party to the principal places of interest in the city. The most interesting manufactory visited was that of the Washburn & Moen Co., where the party were received by Mr. Charles F. Washburn, who took them through the mill and explained the processes by which 80 miles of barbed wire can now be made per day there.

On the evening of the 1st the exhibition took place of the various electrical appliances with which the name of Thomas A. Edison is now associated as inventor the world over. Mr. Edison was presented, and received the warmest welcome, but did not address the assemblage that filled Mechanics' Hall to its utmost capacity. Major Eaton was introduced, and discussed the electric light from a commercial standpoint. He was followed by Mr. Edison's old friend and confidential assistant, Mr. E. H. Johnson, who, remarking that fourteen years of association with the inventor had shown him that the latter did not care to be talked about, proceeded to describe Mr. Edison's inventions. He gave the history and described the nature of the electric light, and illustrated his remarks by numerous experiments. The Edison light was shown in most of its various arrangements and applications. Mr. Johnson also described and operated the Edison phonograph and the Edison carbon telephone.

After this practical and highly interesting lecture, which was followed with the closest attention, some thirty gentlemen met Mr. Edison at an informal lunch at the Bay State House. The exhibition was repeated on the following night.

New York Electrical Society.

At the meeting of the New York Electrical Society, held in the Cooper Union on the evening of May 7, 1884, Dr. Vander Weyde presided. A further discussion on electromotors was held. Dr. Vander Weyde stated that he had been asked by letter whether he indorsed the Sabin motor, and that he now wished to say that he does not.

Many experimental forms of telegraph sounders were exhibited and discussed.

Ocean Telegraphy.

BY WM. MAVER, JR.

PART I.

The first submarine cable of any considerable length was laid in 1850 across the English Channel. It is estimated that there are now about 80,000 miles of submarine cables in operation in all parts of the world, which have been laid at an expense of about $150,000,000.

At present there are eight cables in operation between America and Europe and two more are in process of construction. Four of the above cables are owned by the Anglo-American Company, two by the American Company, and one each by the Direct and French cable companies. The two to be laid will be owned by the Commercial Cable Co., of which Messrs. Bennett and Mackay are the chief owners.

The Anglo-American Company's cables are laid between Valentia, Ireland, and Heart's Content, Newfoundland. Those of the American Cable Company run between

FIG. 1.

Canso, N. S., and Penzance, England. The Direct Company's lies between Torbay, C. B., and Ballin-Skelligs, Ireland, and that of the French Company between Brest, France, and St. Pierre, Miquelon. It is expected that the Bennet-Mackay cables will be laid between Valentia and Dover Bay, Mass. Europe is connected by cable with South America from Spain to Pernambuco.

The principal ports of South America are connected telegraphically by means of submarine cables from port to port. This is also the case with the ports on the east coast of Africa.

Admirable maps, showing the route and length of the various cables, have been issued by Mr. F. N. Gisborne, Superintendent of Telegraphs, under the authority of the Department of Public Works of the Dominion of Canada.

From various causes, such as chafing against sharp rocks at the bottom of the ocean, or from coming afoul of the

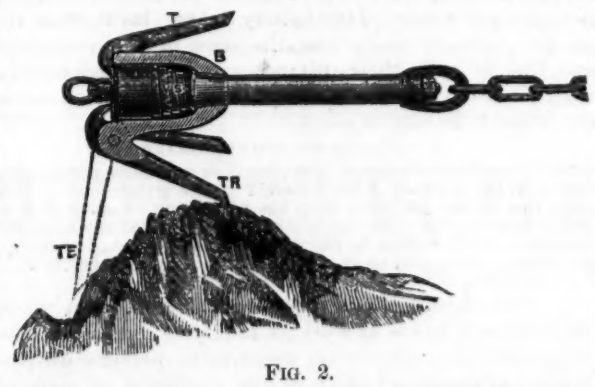


FIG. 2.

anchors of vessels, cables are apt to become broken or injured, but such breaks and injuries can now be located and repaired with remarkable facility.

There are at present twenty-seven vessels engaged in different parts of the world in laying new cables and in repairing old ones.

The vessels employed in this business are provided with paying-out and hauling-in apparatus at the bow and stern, and with all the necessary paraphernalia for picking up broken and damaged cables.

Broken cables are picked up by means of an instrument termed a grapnel.

A grapnel is made of a stout piece of iron two feet long, at one end of which are blunt hooks, as shown in Fig. 1. To the other end of the grapnel the rope is attached. The rope is about an inch and a quarter in diameter, and is made from twisted strands of the strongest hemp. When the vessel arrives at the location of the break, she is steamed considerably to one side of the cable, and then the grapnel and rope are let go. The course of the vessel is steered so that she will sail across the cable. An instrument called a dynamometer is attached to the grapnel rope on the vessel, and this instrument accurately indicates the strain on the rope. The weight of the cable being known, it is easily ascertained when the grapnel has hooked it; should the grapnel become fastened to a rock, the strain, as shown by the dynamometer, rises suddenly, whereas when the cable is caught the strain rises gradually.

Figs. 1 and 2 are illustrations of an improved grapnel invented by Mr. Jamieson. The illustrations are taken from a recent issue in the London *Electrician*. Fig. 1 shows the grapnel as having fast hold of the cable. Fig. 2 shows the grapnel as having run afoul of a rock. The improvement consists of the fact that under such circumstances the hook so connected with a rock at once flies back to the position shown by the dotted lines in Fig. 2, and thus, of course, automatically releases itself. When the cable is hooked it slips into the elbow of the hook, and it may be seen that the only effect it can have on the hook in that position is to keep it more rigidly bent upward.

Some time ago one of the Anglo-American Company's cables was picked up without difficulty in the middle of the Atlantic from a depth of two miles. Another cable was picked up and repaired in the Bay of Biscay from a depth of over three miles.

A cable has been laid across the Atlantic, without a hitch, in the remarkably short time of 12 days.

The price of a cable message at present is fifty cents per word, but lower rates are likely to result from the new competition. This rate has a tendency to cause customers to use their ingenuity in condensing their dispatches into as brief a space as possible. This sometimes has the opposite effect, however, for it is not uncommon to see messages from correspondents asking for more definite instructions or information, as the former abbreviated message was unintelligible.

The rule limiting the length of words to ten letters also has a demoralizing effect upon some of the users of the cables, seemingly, at least, upon their orthography. Thus it is a frequent occurrence to notice "immediately" spelled "immediatly," "dissolution," "disolution," etc., to bring them within the ten letter limit. In technical phraseology such specimens of illiteracy are mildly termed "evasions," and they avail the writers nothing, as the extra toll is invariably collected. Others endeavor to shorten their dispatches by using a foreign language, and running two or three words together in that language, but this device barely suffices to carry the message unquestioned out of the originating country.

When it reaches its destination the evasion is promptly noticed, too, and the extra toll is charged.

Cable messages sometimes undergo amusing transformations at the hands of clerks unfamiliar with the language in which the dispatches are written. I remember having seen a dispatch from Lisbon to a person in New York, about the holiday season, which read, "Wish you all a happy New York."

The bulk of the cable dispatches are sent over the Atlantic cables between the hours of 10 A. M., and 1 P. M., and between 5 P. M., and 9 P. M., New York time. The morning rush is caused in a measure by messages emanating from the Stock Exchanges in London and New York, and as the five hours' difference of time between New York and London only allows of about one hour of simultaneous session of the two Exchanges, the business is necessarily hurried. During that time the New York Stock Exchange is connected directly with the cable terminus at Sydney, Cape Breton.

Answers to stock messages have frequently been received between these two cities within 15 minutes.

On a trial test, on one occasion, an answer was received from London in exactly six minutes. The test was made without previous preparation.

(TO BE CONTINUED).

RACINE, WIS.—The Fuller Electric Light Co. of Chicago have asked permission of the City Council of Racine, Wis., to erect lines and poles for a plant to cost $30,000.

THE B. & M. IN BOSTON.—The quarters vacated by the Eliot National Bank, in the Rialto building, corner of Devonshire and Milk streets, Boston, have been refitted for the use of the Merchants & Bankers' Telegraph Company, which began business in that city on April 28. One evening recently the new offices were inspected by members of the press and others, and were found to be conveniently arranged and admirably fitted up. The receiving department is on the first floor, and is finished in mahogany and marble. The operator's desks are on this floor. The manager has his office also on this floor. In the basement are the messengers' department, stock room, batteries and linemen's waiting room. The uniform for the messengers of the company will be of navy blue, trimmed with light blue cord and brass buttons. On the shoulders will be worn epaulets bearing the initials "B. & M." in gold. The company now has thirty-four Morse instruments and eight duplex machines. The switch board on the operators' floor is a remarkable piece of mechanical ingenuity. The whole force employed by the company in Boston is stated to be something over 100 persons. There are twelve offices in Boston, and at present twenty-two wires to New York, of which eight are duplex. The company already has lines to many of the principal points in New England, and is preparing to extend them to Lowell, Gloucester and Portland during the coming summer. The central Boston office is under the efficient management of Mr. H. J. Pettengill.

The Electrical Development and Manufacturing Co.

This New England corporation has now organized with a strong body of officers. The directors are: Loren N. Downs, the General Manager of the New England Telephone and Telegraph Company; Silas Gurney, President of the Merchants' Electric Light and Power Company, of Boston; Parker C. Chandler, President of the Drawbaugh Telephone and Telegraph Company; Edward H. Goff, President, American Electric and Illuminating Company; A. R. Brewer, Secretary, Western Union Telegraph Company; D. J. Hern, Superintendent, Mutual Union Telegraph Company, Boston; E. A. Leslie, Superintendent. B. & O. Telegraph Company, Boston; Wm. H. Baker, Secretary and Treasurer, Brooklyn District Telegraph Company, N. Y., and H. E. Irvine, Manager, Royal Electric Company, Montreal. Mr. E. H. Goff is President, Mr. L. N. Downs, Vice-President; Mr. Edward S. Sears, Secretary and Treasurer, and Mr. George F. Milliken, General Superintendent. The capital is $500,000 in 10,000 shares of a par value of $50 each, and the company propose to market first 2,000 shares with the object of creating a plant from the proceeds. The company have secured on favorable terms two of the large floors of the building 197 -205 Congress street and the use during the day of the powerful engines, belonging to the Central Station there of the Merchants' Electric Light and Power Company. The floors are each 50 × 125 feet. It is intended to manufacture at once and keep in stock all the leading telegraph, telephone, electric light, insulating and battery supplies, such as are required by the chief companies in the various lines of business. Beyond this, the company propose to carry on a special department for the development of electrical inventions, so that inventors may be given help in perfecting new ideas and devices and in reaping a fair reward for their labors and ingenuity. It is thought that, out of the numerous inventions brought to the attention of the company's experts, it will be possible to select valuable inventions from which large profits can be realized. With its influential directorate, and in view of the rapid growth of electrical applications, the company ought to succeed abundantly. We understand the subscriptions to stock can be paid in installments of one-fourth, the last falling due on January 1, 1885. If the entire amount is paid down, a discount of 5 per cent. is allowed, making the cost of the $50 share $47.50. Subscriptions may be made now.

Catching a Tartar.

It has often been said by the papers of Mr. James R. Keene, the great speculator who is now seriously embarrassed, that he came to New York from the Pacific Slope with the avowed intention of "wiping out" Mr Jay Gould. He has sadly failed in carrying out his ambition, and has occasion to regret that he did not let alone Western Union and other Gould stocks. Leander Richardson tells the following little story about the well-known "pool" in Western Union, against Gould, a few years ago:

"Keene went to work here on methods that were old in Wall street when he was a boy. There were, however, a few men who believed in his audacity. They thought that, with their money and his nerve, they could 'down' Gould. It was thus that the Western Union pool was organized. The Keene crowd had learned from Samuel Hill, a broker of Gould's, that he was short of that stock, and they forced the market up on him at a rate that would have squeezed a good many of the best millionaries in America. He seemed to catch it all around just then, so the story goes, and the big pool, with Keene at its head, came within a hair's breadth of getting him just where he was wanted. They do say he was summoned to meet them at the Windsor and listen to their terms. He went and they told him, that if he wanted to be let up on he must leave Wall street forever. He asked for a little while to consider, and they gave him an hour. He came back in less than that, and told them to come right on as fast as they liked. It rather paralyzed them at the time, but when it subsequently transpired that he held Russell Sage's check for $3,000,000 in his pocket at the time, they got over their astonishment, but not their chagrin. Gould met all his obligations, and the market took a sudden turn in his direction, knocking the pool all to smash, and bringing Keene as a supplicant for mercy. One other big scheme was put up by Keene to kill Gould off. It was called the Lackawanna pool, and Gould was something of a loser by it, though not to an important extent. Keene and his friends began to crow over it, and they never left off until they found themselves, one fine morning, squeezed pretty nearly dry by a little operation of Gould's which has passed into the history of 'the street' as the Northwest pool."

A GLOVED HAND AS A RECEIVER.—It is said that Mr. Giltay, of Delft, has discovered that a gloved hand will act as a receiver when it is put in telephonic circuit. He used an Ader microphone, the primary of an induction coil being connected to it and to three Bunsen cells The secondary of the coil was in circuit with a nine-cell Leclanché battery and the line, the ends of the wire being held in the naked hands of two persons standing in a room some distance away. On whistling or singing near the microphone the sounds were distinctly heard by one of the persons holding the wire line, while the other pressed a gloved hand firmly against his ear. In the case of speech the sounds were too feeble to enable more than a few words to be understood.

DEPARTMENT OF INQUIRIES.

While we are pleased to answer in this department all questions of general interest to our readers, and do so without charge for time or expense, we must request those of our patrons who desire information for their personal interest, and who cannot be properly answered in this way, to send us with their request a small sum, say from $1 to $5, to pay for the time and the expense incurred for their exclusive benefit.

50.—SIZES OF CONDUCTORS IN ELECTRIC LIGHTING.

"Will you kindly give in your next number the proper formula for calculating the size of wire, both leads and branch wires, for an incandescent installation? or where I can get the information, if any published book contains it in full?" J. O. P.
PHILADELPHIA, Pa.

There are no specific formulas relating to this subject. The usual tables of resistances of wires are of practical use to determine the approximate resistance of a given line, and from that and the known current and electromotive force, the power absorbed by the wires may be calculated by either of the formulas of this equation: $E \times C = C^2 \times R =$ power. Economy in expenditure for plant calls for small wires (high resistance); economy in cost of running calls for large wires (small resistance); and safety calls for wires which will carry the currents without heating to a dangerous degree. The problem is to make these opposed conditions applicable in practice.

The National Board of Underwriters and the United Fire Underwriters in America have had prepared for them a full set of instructions and the reasons for their requirements, by Messrs. Morton & Anderson, which book we can send you for $1.50.

51.—MULTIPLEX TELEGRAPHY.

"In La Lumière Electrique, Vol. VII., No. 48, Dec. 2, 1882, I find on page 541 a system of multiple telegraphy proposed by Abbé Laborde, by which 16 to 32 despatches (8 to 16 each way) may be sent over a single wire, at the same time. Has any such system ever come into practical use?" P. A.
CHICAGO, Ill.

The Delany & Calahan system of multiplex telegraphy, which was first described and illustrated in the issue of THE ELECTRICAL WORLD of Dec. 29, 1883, is based upon the plans set forth in the article referred to. The abbé may have referred to the system of La Tour, which Messrs. Delany & Calahan have rendered practical by their devices for insuring synchronism in the movements of the motors at the concentrating and distributing stations. We understand that a line for practical work under this system is in process of erection between Boston and Providence.

52.—PATENT LAW.

(1). "Do the patent laws allow the manufacture of instruments by experimenters for experimental purposes? (2). To whom is the priority of patents referred above the decision of the Commissioner of Patents?" W. C. F.
MONSON, Mass.

The making and use for experiment of the patented apparatus itself is not a penal infringment. But if any profit be derived from the sale or use of the apparatus the maker and user are both liable in damages to the patentee. And the same is the case where the apparatus is used accessory to any other experiment or apparatus in any commercial way, or to obtain results in an experimental laboratory. (2). The decision of the Commissioner of Patents on the question of priority of invention is final. An appeal can be made to the Secretary of the Interior upon question as to whether the decision of the Commissioner is in accordance with the facts as he has stated them and upon other questions of error.

53.—GRAVITY BATTERY.

"What is the electromotive force of a cell of gravity battery and its resistance?" L. F.
LORAIN, O.

The electromotive force is that due to the differences in chemical affinities of copper and zinc for sulphuric acid. It is approximately 1.09 volts; slightly variable with temperature and density of the battery fluids. Its internal resistance varies inversely with the sizes of the electrodes and directly with their distance apart, and indefinitely with the density of the two sulphate solutions, from one or two ohms to twenty or more.

54.—TELEPHONE AND TELEGRAPH.

"Will a private telegraph line placed on telephone poles interfere with the working of the 'phone'? If the middle station on a main line (about 100 miles long) has his ground on north of him and is talking with some one south, can any one at the northern terminus adjust so that by placing his ear on the magnets he can get what is being said on the opposite side of the ground?" J.
CENTRALIA, Ill.

(1.) The telephone will work just as well. But when the telegraph line is at work its inductive action on the telephone line might be so great as to prevent distinct hearing of speech by reason of the confusion of sounds. The amount of this inductive action depends upon the nearness of the lines and the distance over which they run parallel. Of course the possible confusion will only exist in the telephone while the telegraph is being worked. (2.) No. Presumably the circuit is from middle station to southern station, to ground at southern station and from ground to middle station, the northern terminus being thus, if not otherwise, cut out.

55.—TROUBLE IN TELEPHONE SYSTEM.

"Subscriber Z, who has his wire alone, as do all the other subscribers, without extra connections, private switch, or anything which can interfere with the operation of his apparatus, can hear, when connected with them, all the others perfectly. But subscribers A and B, though they can hear all the others perfectly do not get Z but very faintly and confusedly. Z's line is like all the others, same as to switch-board, ground, etc. It cannot be on account of an accidental ground, because the trouble would be experienced by other subscribers. Where am I to look for the trouble? The only defect in Z's circuit is a possible bad ground, owing to the location being on a detritus of an old ship yard." "E. DE H.
"CARDENAS, Cuba."

Can any of our readers suggest the cause of the difficulty and the remedy?

THE TELEGRAPH.

THE BENNETT-MACKAY CABLE.—The steamer "Faraday," with the new cable on board, arrived at Dover Bay on May 6.

POLES IN BROOKLYN, N. Y.—An official report shows that there are 5,817 poles and 3,001 miles of wire used for telegraph and telephone purposes in the city of Brooklyn.

RACINE, WIS.—The American Rapid Co. have applied to the Racine, Wis., City Council for right of way through that city, and will construct lines from Chicago to St. Paul and Minneapolis this summer.

LAYING THE NEW CABLE.—On May 7, the first length of deep sea cable of the Commercial Cable Company was laid by the "Faraday," at Dover Bay, N. S., and congratulations were exchanged between the shore and the steamer. The work will now be actively prosecuted.

POLICE ALARM TELEGRAPHS IN BOSTON.—The City Council of Boston has made a special appropriation of $250,000 for the introduction of a system of police alarm telegraph. The Commissioners have been studying the merits of the Gamewell and the Wilson systems. The Gamewell is widely known and liked. The Wilson is the invention of Mr. John C. Wilson.

LONGITUDE DETERMINED BY TELEGRAPH.—The difference of longitude between Buenos Ayres and Valparaiso has been determined by telegraph by M. Beuf, director of the Naval School of the Argentine Republic; so also has the difference between Valparaiso and Panama, between Valparaiso, Callao, and Lima, between Santiago and Valparaiso, and between Santiago and Cerro-Negro. Various French naval officers have undertaken these last determinations.

THE TELEPHONE.

OMAHA, NEB.—On May 1, the Omaha Exchange, operated by the Nebraska Telephone Co., had 274 paying subscribers. The population is 16,000.

THE SHAVER TELEPHONE.—A certificate has been filed incorporating the Shaver Telephone Company of this State. The capital stock is $2,000,000.

TELEPHONE TAXES IN MAINE.—The telephone companies in Maine have been assessed at a valuation of $83,450, and a taxation of $2,086. The telegraph companies are valued at $248,000, with a taxation of $6,200.

EMMITTSBURGH, MD.—Mr. E. L. Miller and Mr. W. W. Hardesty have been putting up poles and wires there, for telephone purposes, and their work is highly spoken of by the local *Chronicle*. Emmittsburgh is likely to be a prominent exchange centre and to have a good local exchange business.

TO CIRCUMVENT O'DONOVAN ROSSA.—M. de Fonvielle has suggested the following method of detecting infernal machines: All luggage to be placed on wooden tables supported by iron feet, but not nailed to them. A microphone to be placed on each of the tables, when any ticking or other noise proceeding from the luggage would at once become audible.

THE FULLER UNIVERSAL TELEPHONE CO.—The certificate of incorporation of the Fuller Universal Telephone Company was filed in the County Clerk's office on May 5. Its capital stock is $5,000,000, divided into shares of $100, and its incorporators are I. Ensign Fuller, Conrad N. Jordan, Elijah B. Martingdale, William D. Snow, E. Burton Hart, George H. Kendall, William W. Post, William Jeffreys and John M. Moore.

KANKAKEE, ILL.—We have received the latest directory of this exchange, one operated by the Central Union Telephone Company. There are 122 subscribers to it and 12 at Momence, Ill., and the two places connect with sixteen other places. We note that the central offices undertakes to let the subscribers know, whenever possible, whether trains are on time. The directory is tastily printed, and abounds in advertisements, in each of which the telephone number is carefully and conspicuously given.

DOES IT MEAN REIS?—A rumor coming from Germany threatens, if authenticated, to make a considerable difference in the value of stock in telephone companies. It is said that a pamphlet some 20 years old has just been unearthed in some German library, in which an inventor fully describes the telephone and illustrates it by woodcuts. The benevolent author presents his invention to mankind at large as a free gift, and the question may therefore arise whether telephone patents granted only four or five years ago will be of any further value.—*New York Sun.*

THE CENTRAL PENNSYLVANIA CO.—This company, which has lately consolidated with the North Pennsylvania Co., has now 2,200 regular Exchange subscribers and 3,000 sets of instruments in use. The territory embraced by the company is large, covering the following counties: Cameron, Clearfield, Centre, Clinton, Columbia, Blair, Lycoming, Sullivan, Union, Snyder, Northumberland, Juniata, Huntingdon, Mifflin and Montour, together with Lackawanna, Luzerne and Wyoming, the counties operated by the North Pennsylvania company, making a total of eighteen counties. The management feels confident of its ability to make the service of the combined companies second to none in point of equipment and efficiency.

THE ELECTRIC LIGHT.

THE NEW PRODUCE EXCHANGE.—This grand edifice, one of the largest in New York, was opened this week. It is furnished with arc lights by the Excelsior Company, whose incandescent lights are also used in the Safe Deposit vaults underneath the building.

THE BRUSH-SWAN SYSTEM IN THE WEST.—Mr. George Ellett, electrician of the Ogden Electric Light Co,, has recently fitted up the residence of Major V. M. C. Silva there with Swan lamps, to be run by storage batteries. The exhibit has created a great sensation locally.

GOVERNMENT PRINTING OFFICE, WASHINGTON.—The Edison Company is putting in a new and extensive plant for lighting the type setting and press floors of the government printing office, Washington. This is in addition to the plant in the *Record* office, which has been in operation for some time.

THE VAN DEPOELE SYSTEM.—The installation at Muscatine, Iowa, Mr. Frank Stewart, superintendent, is giving great satisfaction. The dynamo is driven by a rated 30 h. p. engine, made by the New York Safety Steam Power Co. At Flint, Mich., a forty-light dynamo is now running at its full capacity, and more are wanted.

BROOKLYN AROUSED AT LAST.—The Brooklyn Aldermen granted permission, on May 5, to the Kings County Electric Light Company to erect poles and stretch wires in the Eastern District of Brooklyn, and a similar privilege in the Western District was granted to the Citizens' Electric Light Company. The companies are to furnish four lights each to the city free, and one other light free to the city for each additional 50 lights supplied to consumers.

EAST BOSTON, MASS.—This place is soon to have the electric light, and the Thomson-Houston system of the American Electric and Illuminating Company has been selected for the purpose. All preliminaries have been arranged, and as soon as the stock has been sold—a large proportion of which has already been subscribed for—the work of constructing the plant will begin. In view of the size of East Boston, which contains 35,000 inhabitants, it is thought that the company will be a brilliant success.

IN ENGLAND.—The applications for provisional orders made to the Board of Trade, number four, with a capital of $330,000, one being made by the corporation of Bury, St. Edmunds, to supply electricity to the borough of St. Edmunds, Suffolk. The other three are made by companies. The Edison and Swan United Electric Light Company Limited ask to have the rights, powers, and obligations of the Edison Electric Light Company and of the Swan United Electric Light Company transferred to the new company.

LIGHTING SAN FRANCISCO.—The San Francisco *Daily Report* says: "The contract for lighting the streets of San Francisco is about to be let by the Board of Supervisors. The competing bidders are the San Francisco Gaslight Company and the California Electric Light Company. The electric light is undoubtedly the most useful for the purposes of street illumination. It is brilliant and searching and can be relied upon. The question is which is the best for the people—gas or electric light—at the rate offered by the two corporations."

AUBURN, N. Y.—A number of gentlemen at Auburn, N. Y. interested in electric lighting have formed a local Brush-Swan Co. with a capital stock of $100,000 in 1,000 shares. The organizers of the company are J. A. Cook, J. W. Dunning, J. S. Fowler, E. D. Clapp, E. M. Birdsall, C. A. Smith, B. C. Smith, E. M. Avery and John E. Allen. It is understood that the purpose of the company is to purchase the plant and assume the liabilities of the Steam Heating Company, a privilege given them by the terms of their lease of the property.

THE NEW ORLEANS EXPOSITION.—To light the building with incandescent lamps will require 15,000 lights and 1,800 horse-power. To light with the arc system will require 700 lamps and 700 horse-power to operate the dynamo. The total steam required for lighting and for Machinery Hall will be at least 3,000 horse-power. In this estimate is included the power for five arc lights of 36,000 candle-power each, which will light the grounds. These are the largest single lamps ever constructed. The building will be in complete readiness for the reception of articles intended for exhibition by the middle of August.

THE EXCELSIOR SYSTEM WEST.—The Standard Theatre, Chicago, is lighted by the Excelsior Electric Light Company, with arc and incandescent lamps on the same circuit and fed by the same dynamo. This plant, the first of the kind in practical operation out West, was furnished by Mr. F. W. Horne. This gentleman has also been awarded by the American Panorama Company, of Chicago, who will exhibit the "Siege of Paris," the contract for lighting it with 25 arc lamps, and incandescent lamps from the same source of current for the private rooms and offices. The directors had investigated all the standard systems before making their choice.

THE FAWCETT HIGH-SPEED ENGINE.—E. Fawcett & Son, of the Alliance Industrial Works, Alliance, O., have lately introduced upright and horizontal high-speed engines for electric lighting. They furnished one to run the Thomson-Houston dynamo, at the Pittsburgh Exposition, last October. It ran their direct-acting saw mill during the day and the dynamo at night, furnishing twenty-nine lights; but the fire there destroyed engine, indicator, cards, data—the whole exhibit, in fact. The senior of the firm, a member of the Society of Mechanical Engineers, has for many years manufactured high-speed engines specially for saw mills, and has, also, in association with Mr. J. W. Tompson, the inventor of the Tompson indicator, experimented with electro magnetism and electrical machines. He is thus familiar with the requirement of engines for electric ligh ting purposes.

MISCELLANEOUS NOTES.

MESSRS. TORRY AND PALMER, of the Utica Fire Alarm Telegraph Company, were in New York last week. They report that business with their company is very fair. Mr. Torry has recently returned from a trip through the West, and reports matters in the electrical line in that section to be generally prosperous.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS.—As previously announced, a scheme of organization for the above society will be presented at the meeting to be held on Tuesday next, at 8 P. M., at the rooms of the American Society of Civil Engineers. More than 200 gentlemen have already given their support to the movement, and a very large attendance is expected at what must be a memorable meeting.

THE "GET UP" OF AMERICAN SCIENTIFIC BOOKS.—The English *Electrician* of April 19, in a favorable review of Lieut. Fiske's "Electricity in Theory and Practice," takes occasion to say: "Although the 'get up' of the English books we have noticed is very good, yet when compared with this book from America, they are nowhere. We have had some experience during the past quarter of a century in the production of school and other books, and so far as the mere mechanical processes are concerned, we think America stands far and away ahead of every other nation. German, Italian and Spanish books are usually printed on bad paper, with thin covers that are torn off almost as soon as handled. French books are little if any better. England is in advance, so far as the old world is concerned, while America eclipses all. In the matter of an 'index,' it would be almost impossible to imagine an American book without one." This is highly complimentary to American publishers generally, and to the house of D. Van Nostrand in particular.

STOCK QUOTATIONS.

Telegraph, telephone and electric light stocks were quoted as follows on Thursday at the Electric, Manufacturing and Miscellaneous Stock Exchange, and at the Stock Exchange:

TELEGRAPH.—American Rapid, b 50, a 65; Commercial Telegram Company Pref'd, a 109; Commercial Telegram Common, a 95; Harlem District Telegraph Co., a 5.50; Manhattan Telegraph, b 10, a 85; Mexican, b 125, a 147; Northern & Southern Tel. Co. 1st mtge bonds, b 74, a 78; Postal Telegraph (stock), b 5.88, a 6.13; Postal Telegraph bonds, 1st 6 per cent., b 52.25, a 53.50; Postal Telegraph and Cable Co., b 12, a 13.50; B. & M. Co., b 119, a 119¾; Am. Cable, a 55; Western Union, b 60⅝, a 60½.

It is said that the Western Union Company will reduce their rate of dividend from 7 to 6 per cent.

TELEPHONE.—American Bell, b 163¼, a 164; American Speaking, b 110, a 125; Currier Telephone Bell, b 3; Continental, b 15; Dolbear, b 5, a 10; Erie, b 30, a 31; Globe, b 5, a 7.25; Hudson River, b 60, a 90; Inter-Continental, b 95, a 1.25; Mexican, b 2.50, a 3.25; Mexican Central, a 2.50; Molecular, b 7, a 13; New England, b 29, a 29.50; New York, a 85; New York and New Jersey, a 80; New York and Pennsylvania, b 50, a 80; Overland, b 10, a 15; People's, b 10.50, a 12; People's (N. E.), b 1.50; Shaw, b 20; Solenoid, a 90; Southern Bell, b 95, a 125; Southern New England, a 175; Tropical, b 2, a 2.50; West India Telegraph and Telephone, b 2, a 2.25.

The Boston *Herald* of May 8, reports the local market as follows: "Telephone shares were irregular, Bell being heavy at 162 @161, and Erie stronger at 26. Currier Bell stock, at one time quoted at about 100, is now 15 asked; Southeastern is 120 bid; Union, 60 bid; and People's (parent), 11½ bid."

ELECTRIC LIGHT.—American, b 2, a 4; Baxter, b 22, a 23; Brush, b 50, a 80; Brush Illuminating, b 45, a 70; Daft, b 40, a 60; Edison, b 100, a 125; Edison Illuminating, b 55, a 75; Edison Isolated, a 90; Excelsior, a 35; Swan Incandescent, b 15, a 40; United States, b 90, a 95; United States Ill. Co., a 90.

BUSINESS NOTICES.

L. N. CLARK & SON, 83 Liberty street, have a "Perfect Hatcher and Brooder" in operation, with electrical heat regulator, and little live chickens, produced by its means, can be seen hopping about their office now and during next week.

REMOVAL.—Pride, Fraleigh & Kyle, telegraph engineers, electricians and contractors, late of 23 and 25 Dey street, are now to be found at 13, same street, where they have increased their facilities for doing business, and are prepared to fill the largest orders.

J. L. LAZELLE & Co. have moved to 110 Liberty street, this city, where they continue their large business in electric burglar alarms, electric annunciators, electric call-bells, medical batteries, Edison pens, outfits, supplies and repairs. The firm may be relied upon to do thoroughly all kinds of electrical and mechanical experimental work.

ELECTRO-MEDICAL APPARATUS.—We take the opportunity to call attention again to the electro-medical apparatus manufactured by the Jerome Kidder Manufacturing Co., 820 Broadway, New York. We would suggest that purchasers of such apparatus write for a circular of their goods before placing orders. During the Fall of 1883 the highest awards were given to their superior Electro Medical Apparatus by the American Institute of this city, Cincinnati Industrial Exposition, and the St. Louis, Ky., Exposition. Upon receipt of name and address of any one desiring to obtain the apparatus the company will mail a 40 page pamphlet free.

ELECTRICAL APPARATUS.—E. B. Benjamin, of 6 Barclay and 12 Vesey street, this city, has long been honorably known as a manufacturer of scientific and chemical apparatus of all kinds. He is paying special attention to electrical apparatus of every description. We inspected some of his latest productions a few days ago, and were greatly pleased with the high finish and stability of the various articles, as well as with the prices charged. It seems to us that Mr. Benjamin's goods ought to be widely known, as they certainly must be greatly appreciated by students and investigators of electrical phenomena. Particulars may be obtained on application. Mr. Benjamin supplies rotary and lever air pumps in brass, after Leslie's system, Geissler and Sprengel glass pumps, and all kinds of special glass apparatus will be made to order, as well as electrical apparatus of any kind. We saw some incandescent lamps at 6 Barclay, of novel principle, and the workmanship in them was admirable.

THE BARTHEL METHOD OF LUBRICATION.—A. E. Barthel, represented by Mr. R. A. Goodchild, 111 Liberty street, New York, has a method of lubrication that is well worthy of notice on the part of electrical engineers. It comprises a solidified oil and lubricating compound, and the Staufer, Reisert, and Barthel patent lubricators especially adapted to its use. The oil is pure, efficient and economical, is not affected by heat or cold, and does not run out of bearings. It is adapted to all classes of machinery, and has a peculiar suitability to electrical machinery. In regard to the great efficiency of this solidified oil and lubricators to be used in connection with it, Mr. Barthel has references among the best known electric light companies on the Continent, also numerous railroad companies, steamship companies, manufacturers and others useing large quantities of his oil. Mr. Barthel can produce written references of the highest character from the Continent and the United States. His catalogue which contains many of these and numerous additional references, will be sent on receipt of name and address. Messrs. Siemens Bros. have had the lubricators in use for the last year on their dynamo machine, employed in lighting the town of Godalming, England. They have there given entire satisfaction, not simply because they are found to effect a saving of 90 per cent., but because the lubricant is confined to the bearing and does not spread to other parts of the machine. Our readers know that this is a strong recommendation for any lubricant used on electrical machinery. A saving of from 50 to 75 per cent. is guaranteed over the old methods as a result of the use of the lubricators and the solidified oil, to say nothing of perfect cleanliness, reduced wear of bearings, saving of time, and the avoidance of hot boxes.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

Edited by N. S. KEITH, Electrical Engineer and Expert, 9 Murray Street, New York.

PATENTS DATED APRIL 22, 1884.

Anti-Induction Electric Conductor; Sidney F. Shelburne, New York, N. Y..... 297,176

Consists in the combination in series of the following elements: first, an electric conductor; second, an insulating material inclosing the electric conductor; third, an induction-shield covering and inclosing the insulating material of paramagnetic substance; fourth, a coating of insulating material surrounding the whole.

Apparatus to be Used in Electric Rail or Tramway Systems; Michael Holroyd Smith, of Halifax, County of York, England..... 297,306

Consists in modifications, by the application of which the use of trolleys or bogies may be dispensed with, as the conductors are formed of more or less longitudinally-slotted tube-shaped sections, in which suitable shuttles and spring-collectors are caused to travel, the current being passed from such collectors to the driving-motor by means of suitable connections.

Combined Electric Light and Telegraph Post; Sidney F. Shelburne, New York, N. Y..... 297,182

This post is made hollow, of iron, and the several wires are run within the tube. Under a cap at top branches of the wires are run out to buildings or elsewhere.

Conduit for Underground Telegraph Wires; Emil O. Hildebrand, of Chicago, Ill..... 297,397

An earthenware conduit having a U shape, provided with diaphragms perforated to receive the wires and keep them asunder.

Conductor for Telephone and Telegraph Purposes; William Jamieson, of New York, N. Y..... 297,406

Conducting wires are helically wound over a core of other conducting wires. The two wires forming each circuit are interspaced with the others, so that they are separated from each other by one or more wires belonging to the other circuits.

Conduit for Underground Lines; Thomas L. Smith, of New York, N. Y., assignor of one-half to Daniel A. Mathews, of same place..... 297,463

At branch-junctions posts are provided within the conduit. The posts are used as corners on which to bend the conducting wires, which are run from the main conduit into the branches.

Conduit and Attachment for Electric Conductors; Sidney F. Shelburne, of New York, N. Y. 297,183

Consists of a provision of a main channel or channels within a conduit made of wood, cement or equivalent bituminous plastic material, in combination with special channels for single insulated conductors arranged above each other in and near the sides of the conduits, through which they may be readily distinguished and taken at pleasure into adjacent buildings. And also lateral openings and threaded nipples, corresponding to the size and number of insulated conductors.

Coupling for Lightning Rods; Theodore H. Patee, of Greencastle, Ind..... 297,290

The ends of the sections are dovetailed and secured in sockets on the couplings which are screwed together.

Electric Light Fixture; Philip H. Klein, Jr., of New York, N. Y., assignor to Bergmann & Co., of same place..... 297,269

Flexible continuous conductors are passed through a tubular fixture like a wall-bracket. The joints are made something like steam-fitting unions.

Electric Cable; Sidney F. Shelburne, of New York, N. Y..... 297,177

A series of strands for an electric cable, each composed of two or more separately-insulated conductors formed into a helix about each other, and arranged in succeeding divisions within a line or lines of cable, so that the spirals of the strand in any one division are reversed in direction with reference to the spirals of the connecting strand or conductors in the preceding division, for the purpose of balancing currents of induction.

Electric-Light Tower; John S. Adams, of Elgin, Illinois, assignor to the Detroit Iron Tower Co., of Detroit, Mich..... 297,332

The objects of the invention are, first, to provide for supporting one or more electric lights above the tower proper; second, to provide means by which the elevated lamps may be lowered to or near the base of the tower, for supplying fresh carbons or for repairs, and thereby avoid the necessity of climbing the tower for these purposes; third, to provide a suitable carriage supporting the lamps, and ways guiding the carriage to and from the top of the tower; fourth, to provide for the arrangement of the lamps upon the carriage whereby the lamps are raised and lowered in the angles of the tower; and, finally, to provide suitable and effective means for actuating and counterbalancing the carriage and lamps when raising and lowering them.

Field Magnet for Dynamo-Electric Machine; John W. Lawson, of Harrison, N. J..... 297,273

The cores are made of bundled wires.

Incandescent Electric Lamp; Tom Ernest Gatehouse, of Camberwell, County of Surrey, England... 297,377

Within the globe a platinum filament and a carbon filament are connected in series. The sizes and resistances of these are so proportioned that the rise of resistance due to heat in one is compensated by the fall of resistance from the same cause in the other, so that the current strength under constant tension remains the same.

Insulated Electric Conductor or Cable; Sidney F. Shelburne, New York, N. Y..... 297,175

Consists of strands of insulated conductors interwoven with each other in pairs, and arranged in circumferential layers, each outward layer passing in spirals of opposite direction to those of the adjacent series.

Insulator for Telegraph Wires; Luther C. Baldwin, and John C. Thurston, of Manchester, N. H.... 297,101

Consists in a cup of some non-conducting material, preferably glass, having its interior shaped to receive the supporting pin, in combination with a pin adapted to be inserted and turned, and then farther inserted, to lock and form a firm bearing for the cup.

Junction Box for Electric Circuits; Alexander P. Wright, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y.... 297,547

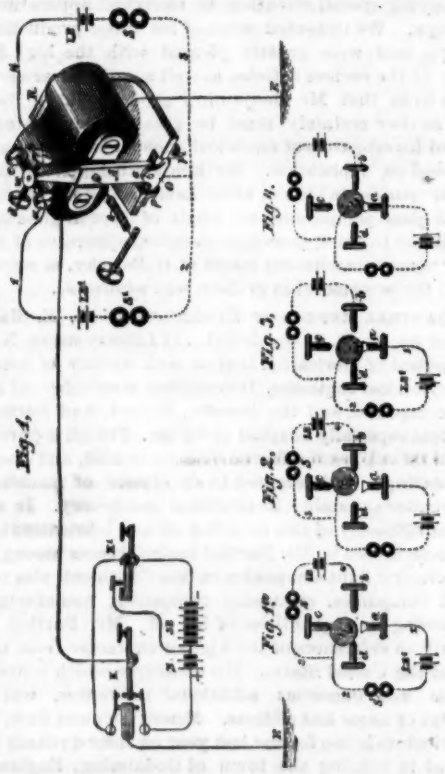
The slats having grooves cut in them to receive the conducting wires have pieces cut out of the n on the side toward which the branch is run and then a piece is inserted in the space so provided. This piece has suitable grooves cut in it to receive the bends of the wires.

Means for Controlling and Limiting Induction; Sidney F. Shelburne, New York, N. Y..... 297,178

An insulated conductor is covered with an insulated helix of metal, and put into a conduit. The helices are, at the junction or test boxes, connected across the bared conductor, so that a continuous electrical connection is preserved between the helices.

Duplex or Quadruplex Telegraph; Gerritt Smith, of Astoria, N. Y..... 297,540

This invention is calculated to avoid the possibility of false signals, due to a momentary cessation of magnetism in the neutral relay of a multiplex system. This is done by means of apparatus which allows of the withdrawal of the neutral relay. The operation of the device may be described as follows: Transmitters K and K' both open; current to line + 4 B; armature A assumes a left front position, and disc w rests between stops c



and d, Fig. 1; both local circuits are open. Transmitter K closed, K' open; current to line — 4 B; armature A assumes a right front contact; disc w rests between stops b and c, Fig. 2; local circuit of sounder S is closed *via* the elements A, 3, S, L B, 4 b and w; sounder S responds. Transmitter K' closed, K open; current to line + B; armature A assumes a rear left position and disc w rests between stops a and d, Fig. 3; local circuit of sounder S' is closed *via* elements a, 1, L B', S', 2, A and w; sounder S' responds. Transmitters K and K' both closed; current to line — B; armature A assumes a rear right position; disc w rests between stops a and b, Fig. 4; both local circuits are closed; both sounders respond. It will thus be seen that sounder S responds only to the operation of transmitter K, and that sounder S' responds only to the operation of transmitter K'

Method of and Means for Laying Subterranean Cables; Sidney F. Shelburne, New York, N. Y..... 297,179

A D-shaped conduit is provided and compound cables are drawn into it, but small trucks or rollers are provided for the support of the cable in the conduit, and to reduce friction, etc., during the drawing in. The trucks are inserted at the entrance of the conduit at suitable intervals during the operation.

Method of and Apparatus for Insulating Electric Cables; Sidney F. Shelburne, New York, N. Y. 297,181

The method of and apparatus for insulating conductors; the method consisting in first removing the air particles from fibrous materials surrounding the conductor, simultaneously applying heat thereto; then saturating such fibres and filling the same and inclosing tube with melted insulating material; then gradually cooling the tube, commencing at the end remote from the supply of insulating material, the liquid portion of such material being kept under pressure within the tube.

Protector for Telegraph and Telephone Instruments; Elias M. Greene, of New York, N. Y.. 297,385

Devices whereby abnormal currents excite electro-magnets which move armatures into contacts with earth circuits, and thus break the normal circuits and provide others for the abnormal currents.

Protecting Electric Conductors from Induction; Sidney F. Shelburne, New York, N. Y..... 297,184

Each conductor is first insulated. It is then covered with an inclosure of very thin copper, put on spirally in strips, in the same manner as taping. Another wrapping or coating of insulation is then added over the thin copper. The conductors thus prepared are then formed into cables, either parallel to each other or in strands or spirals. The thin copper spirals are electrically connected at the ends of the cables.

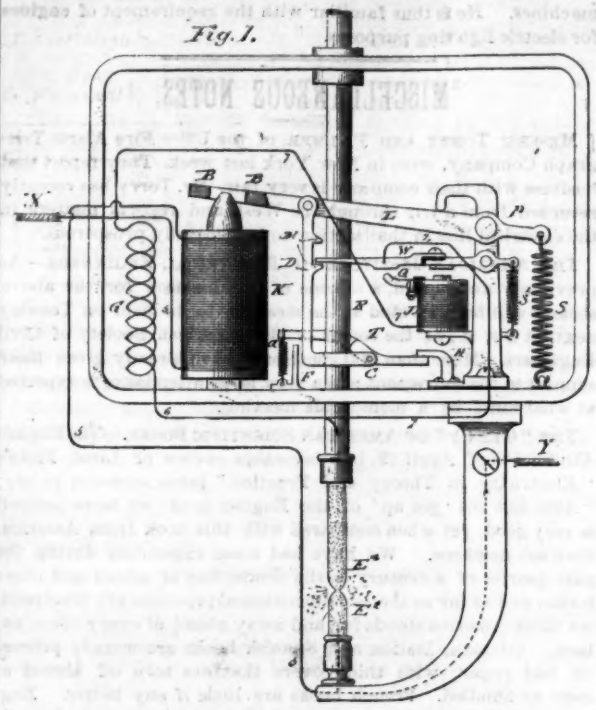
Rheostat; Edward Weston, of Newark, N. J., assignor to the United States Electric Lighting Co., of New York, N. Y..... 297,324

A suitable number of thin boards of insulating material have the bare conducting wire wound upon them in notches, so as to keep the convolutions apart, and then these boards are put into a frame, but separated so that ventilation is secured. The wires are connected in series by means of contact plates, upon which a conducting arm moves to derive the current from any desired plate or number of board coils.

Electric Arc Lamps; Elihu Thomson, of Lynn, Mass., assignor to the Thomson-Houston Electric Co., of Connecticut.....Nos. 297,194, 297,195, 297,196, 297,197, 297,198, 297,199, 297,200, 297,201

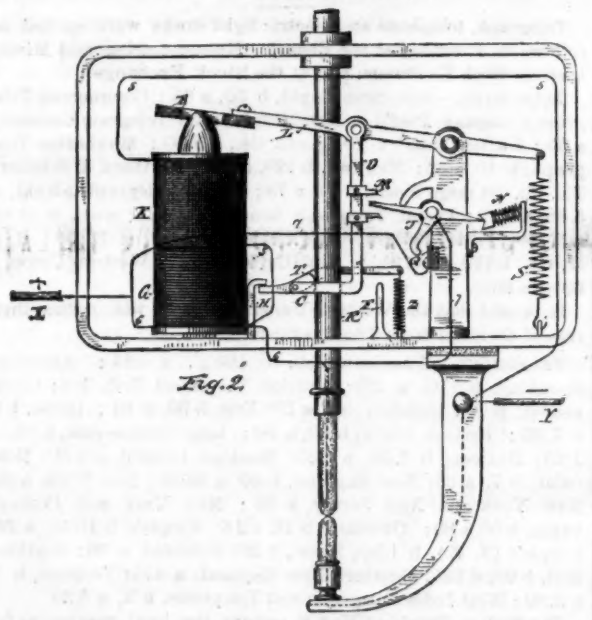
This series of patents embraces various electrical, magnetical and mechanical devices for insuring the passage of a momentary current through an electromagnet of high resistance in a circuit around the arc, for the purpose of bringing its armature and

Fig. 1.

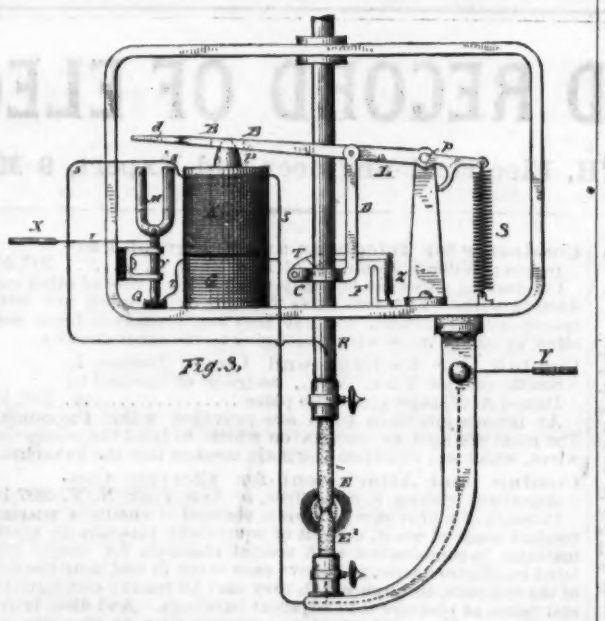


attached clamps into position for lifting the carbon rod to form the arc, and thereafter alone control the feed of the lamp. Fig. 1 illustrates the principle and one of the combinations of devices.

When the lamp is out of action the parts are in the position shown, and there are then two paths through the lamp—one a branch including the magnet K, and the other a branch including the resistance G and the carbons—so that when current is turned on the resistance G will force the current into K, and the latter will thus be enabled to draw down its armature and lower



the feed mechanism to operative position. In this movement the switch W is operated, and the resistance G is cut out by the closing of contact at Q at just about the time that the toe T is released by the stop F. The current now flows mainly through the carbons, and the power of the magnet K is weakened (its relation to the circuits now being the ordinary relation), so that the retractor S prevails, and the clutch is lifted and separates the carbons until a point is reached where, through the increased current forced into K by the drawing of the arc, the power of the



magnet and the spring S are balanced. In the meantime the shunt 7 is held closed by the magnet J, and the feed and control of the upper carbon are now maintained in the well-known and obvious manner by the variations in the power of the derived circuit magnet attendant upon variations in the length of arc. When the current is turned off the lever L is retracted to such an extent that the shunt 7 is opened, thus putting the resistance G into circuit, and the clutch is raised, so as to come into contact with the upper releasing-stop and free the clutch from the rod R.

Another arrangement of devices is illustrated by Fig. 2, which shows the position of the parts when the lamp is out of action and no current is passing. The contacts Q are open, the clutch released by stop H, and the carbons in contact. When current is turned on, the coil G acts strongly upon the core and pulls down lever L until the clutch is brought to the ordinary or feed-regulating position or plane, and when the stop F is reached the circuit-controller J is operated and the coil G is cut out, remaining out until the lever is drawn back to its extreme position. The carbons are now left to the sole control of the coil K, and the adjustment and feed proceed in the well-known and ordinary manner.

Fig. 3 illustrates another method. When lever L is pulled down it attracts and lifts the permanent magnet M, and this breaks the circuit of G at Q; and then K acts alone on L.

Secondary Battery; William A. Shaw, of Pittsburgh, Pa., assignor to The Electrical Accumulator Co., of New York, N. Y..... 297,457

Consists in corroding the plates or bodies of the elements by chemical agents—such as nitric, nitro-sulphuric, acetic, hydrochloric or other acid, or a saturated solution of nitrate of soda or potash—preparatory to placing them in the electrolyte of the secondary cells.

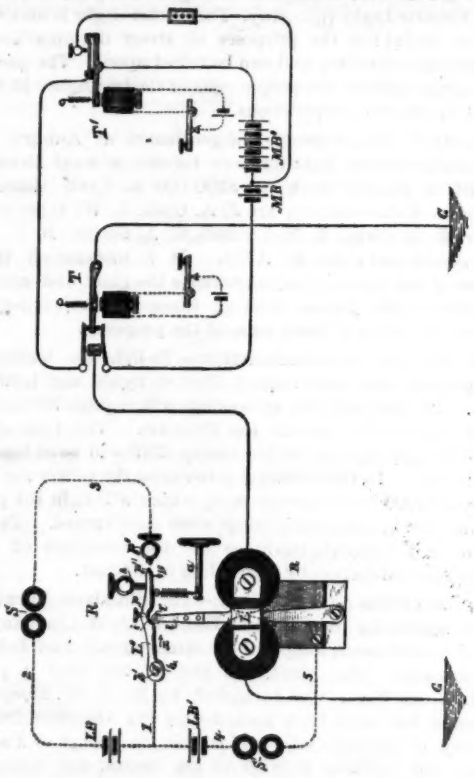
Submarine Telegraph Cable; Sidney F. Shelburne, New York, N. Y..... 297,180

An electric cable composed of three conductors insulated from each other, one central and the others annular about it, combined so that the central or first annular forms the signal conductor, and the ends of the remaining two are connected together, completing an induction-guard circuit.

Quadruplex Telegraph; Gerritt Smith, of Astoria, N. Y..... 297,186

Employs only a single polarized relay which is responsive to both variations in strength and reversals of current, and avoids difficulty from secondary currents set up in receiving relays.

The operation is as follows: The transmitters T and T' and relay R are shown in their normal position, a current of — 4 to line, armature-lever L and auxiliary shuttle-lever L' in their extreme minus position, and both local circuits open. If T be closed, T' remaining open, a current of + 4 to line, armature-lever L will pass to its extreme plus position, and by force of its frictional connection with L' will impart to L' a longitudinal movement sufficient to make contact between p' and p''. The circuit of L B is formed through the elements p' 3, S, 2, L B, l, L' p'', and sounder S responds. In this movement of L from



one extreme position to the opposite extreme, L passes over point p; but the contact between l' and p is found, in practice, of too short duration to affect sounder S'. With T' closed, T open, a current of —1, armature L assumes a nearly central position, and the circuit of L B' is completed through the elements 5, L, l', p, L', l, L B', 4, S', and sounder S' responds. With T and T' both closed, a current + 1, L assumes a position nearly central, but is actuated to move L' in its longitudinal direction sufficiently to form contact between p' and p'', while it maintains electrical contact between l' and p, thus completing the local circuits of both sounders S and S'. It is thus seen that sounder S always responds to reversals, whether of the entire main battery or of the smaller end only, and that sounder S' responds to an increase or decrease of current strength only.

Telephone; James H. Rogers, of New York, N. Y.. 297,168

The diaphragm has two carbon standards, a loose and electrode mounted upon them.

Telephone; James H. Rogers, of New York, N. Y... 297,167

Is either a transmitter or a receiver, and has a diaphragm of carbon or metal carrying two adjustable electrodes adapted to be brought directly into contact with each other.

Telephone; Henry B. T. Strangways, of London, England..... 297,470

Consists in the combination with the diaphragm of a small electro-magnet fastened thereto, and placed in parallel circuit with the wire of the coil on the main magnet.

Telephone Call and Switch-box; Edwin H. McHall, of Memphis, Tenn..... 297,148

Consists in a novel arrangement of switch and circuit in telephone-boxes, for maintaining a closed circuit at all times on lines connecting three or more instruments.

Telephone; James H. Rogers, of New York, N. Y... 297,166

Two ordinary horseshoe permanent magnets are bound, one on each side, to two soft-iron forms shaped like one-half of one of the magnets. The soft-iron forms have polar extensions at right angles, so that they point toward each other when bound to the magnets. The wire bobbins are slipped on these extensions before the other parts are assembled.

Train-Signal; Marcus F. Parrish and Schuyler J. Munn, of Niles, Mich., Assignors of one-third to Charles W. Millard, of same place..... 297,438

Consists in providing the cab of the engine with an electrical generator or other means of supplying electricity, with an alarm and telephone or equivalent devices for transmitting and receiving signals and communications, and with an adjustable conducting-arm adapted to engage a line of wire located along the line of the track.

Underground Wire-Conduit; Thomas L. Smith, of New York, N. Y., assignor of one-half to Daniel A. Mathews, of same place..... 297,462

A wall is made between two sections of the conduit; and in this wall bolts pass from side to side. The wall bolts have eyes on both ends, to which the wires within the sections are fastened.